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SELECTIONS FROM THE RECORDS OF THE BOMBAY GOVERNMENT.

IRRIGATION SERIES.—No. III.

IRRIGATION PROJECTS

FOR

THE BOMBAY PRESIDENCY.

LAND IN THE PAIHRA AND GODAVERY VALLEYS,

NEAR

NEWASSA,

IN THE AHMEDNUGGUR COLLECTORATE.

(THE LAKH PROJECT.)

WITH A MAP & PLANS.

PLANS IN A SEPARATE CASE.

Bombay:

PRINTED FOR GOVERNMENT, BY PEARSE AND SORABJEE.

1866.

MEMORANDUM.

Dam—Length 1,500 feet. Greatest height 15 feet. Cost Rs. 58,783.

Canal—Length 21 miles. Cost Rs. 1,00,167.

Average lowest breadth 13 feet. Fall to the 6th mile 1 foot.

10 „ „ to the 18th „ 1½ „

9 „ „ to the 21st „ 2 „

16 Aqueducts.

5 Escapes.

10 Communication Bridges.

1 Bungalow and Out-houses.

Total cost, Rs. 2,11,292.

Area irrigable 18,000 acres.

Probable Net Revenue:—

Mr. Griffith's (Executive Engineer) Estimate Rs. 32,365.

Major Francis' (Revenue Survey) „ „ 40,235.

Estimate of maintenance Rs. 10,035, *i. e.* 5 per cent on the Estimate.

No. 2077 of 1865.

Public Works Department.

From the Acting Revenue Commissioner S. D.,

To the Chief Secretary to Government.

Poona, 19*th June* 1865.

Sir,—I have the honor to submit herewith, in original, a letter from the Superintending Engineer for Irrigation, No. 72, dated 25th January 1865, together with its accompaniments, among which are Plans and Estimates for a project for irrigating 18,000 acres of land in the Pailra and Godavery Valleys, near Newassa, in the Ahmednuggur Collectorate.

2. The Commissioner of Survey, Major Francis, having been requested by Mr. Morgan, Acting Revenue Commissioner in letter No. 523, dated 11th February 1865, to favor this Department with his opinion on the project, has made the following remarks:—

> "2.—I agree with the Collector, that the Executive "Engineers' water rates are too low, but at the same time, "I consider his own to be too high to be safely taken as "the basis for estimating the out-turn of this project: nine "Rupees per acre, which is the Collector's maximum for "perennial irrigation, would not, I admit, be thought high "on old Established Irrigational Works; but in carrying "out a new work of this kind, we must take into account "the circumstance of the people of the District not being "accustomed to irrigated cultivation, and consequently not "alive to the profits derivable therefrom, and therefore "that favorable rates are required in the first instance, to "induce them to take to a new kind of cultivation. I

" think, therefore, it would be advisable on this and other " accounts, to have our rates lower than they would be " under ordinary circumstances.

" 3 .It is my opinion, therefore, that for perennial water " the rate should not exceed six rupees per acre at first. " This is exclusive of the regular Jerayet or dry crop as- " sessment imposed under the Survey Assessment. I " would also fix a lower sum for the cold weather and " monsoon water rates, which should not, I think, exceed " four and two rupees per acre respectively. The above " would generally assimilate to the rates fixed for Patthus- " thul lands in other parts of the Collectorate, and might " therefore continue in force till a general revision of the " settlement of the District takes place.

" 4. The estimated annual revenue derivable from the " project, according to the foregoing rates, would be, as " follows :—

" 1,500 acres under perennial irrigation at the " rate of rupees 6 per acre.....	9,000
" 5,400 under rubbee crops at rupees 4 per acre.	21,600
" 10,100 under monsoon crops at rupees 2 per " acre.....	20,200
" Total Estimated annual Return.....	50,800
Deduct :	
" Annual maintenance charges at 5 per cent, " on outlay.....	10,565
Rupees.....	40,235

" Calculated upon these rates the scheme is estimated to " yield a return of nearly 20 per cent on the outlay.

" 5. There can, I think, be no question that in a finan-

" cial point of view, the project will be highly remunera-
" tive; for whether you take the Collector's comparatively
" high Estimate of realizable revenue, or my own more
" moderate, or the Executive Engineers' low return, the
" result in any case will be extremely favorable."

3. I concur in the views expressed by Major Francis in paras. 2 and 3, and would beg to recommend the adoption of the rates proposed by him, although they are somewhat lower than they would be under ordinary circumstances.

4. Government will observe that even under the lower rates proposed by Major Francis, the result of the project is likely to be very favorable in a financial point of view.

I have the honor to be,
Sir,
Your most obedient servant,
J. W. HADOW,
Acting Revenue Commissioner S. D.

No. 72 of 1865.

Public Works Department.

From Lieut. Col. Fife, Superintending Engineer for Irrigation,

To the Revenue Commissioner, Southern Division,
Poona.

Camp Konoor, 25th January 1865.

Sir,—I have the honor to forward for submission to Government for sanction Plans and Estimates for a project for irrigating 18,000 acres in the Paihra and Godavery Valleys, near Newassa in the Ahmednuggur Collectorate.

2. The merit of suggesting this project and shewing its practicability and great promise is due to Captain Finch who has recently returned to his old appointment at Ahmednuggur. In fact Captain Finch went so far as to prepare an estimate for the work in 1861, but the plans could never be found after Captain Finch's departure to England, and the estimate was not considered sufficiently detailed for the project to be sanctioned by Government till a detailed survey was made.

3. The requisite survey was commenced in October 1863, by Mr. Griffith, who had been specially appointed for irrigation works in the Ahmednuggur Collectorate, and the Plans and Estimate now submitted are the result of his labours. I may add that the project would long ago have been submitted by him, but for his having latterly had double duties to carry on, and I know that it was only by extraordinary exertion, from which I believe his health suffered, that he has been enabled to furnish the project before his departure on sick certificate to England.

4. The River Paihra whence the project will draw its supply of water is a branch of the Godavery, and is fed from the Western Ghats. Its perennial stream is large for so small a river. During the monsoon, the supply of water is of course enormous, and I am sure this work will be a most successful one. If more perennial irrigation should ever be required than the present perennial stream will suffice for, it can be afforded by adding a temporary earthern dam to the top of the weir during the fair season, and ponding up a supply of water against the hot weather, and catching any occasional showers that may fall in April or May.

5. The details of the plans have been very carefully discussed by myself and Mr. Griffith, and many of them have been modified to meet my views. I have now merely therefore to mention that, with the exception of two or three minor points on which a memorandum is attached to this letter, I approve of the plans and estimates.

6. With respect to the Revenue Return that will be obtain-

ed from this work I beg to forward a letter No. 1779, dated 3rd September 1864, from the Collector of Ahmednuggur. The rates of assessment on which Mr. Griffith bases his estimate of return are those which were fixed by Major Anderson, Superintendent of Revenue Survey, for the Kristna Irrigation. They are certainly low, and Mr. D'Oyly recommends much higher rates. My own impression is that low rates are best at first, and I think that where there is such a material difference in the value of the perennial crops, such as sugar-cane, and the monsoon crops, such as jowarree, it would be best to commence with a crop assessment till the people learn to use the water properly, and learn what effect can be produced by a given quantity of water. These are, however, points which may be discussed hereafter. It will be sufficient to mention here that the low rates used by Mr. Griffith even, show a net return of Rupees 31,835 or 15 per cent on an outlay of Rupees 211,298.

Gross Revenue Rs	42,400
Deduct:—	
5 per cent on Rs. 211,298 for working Expences	10,565
Net Revenue Rs.	31,835

7.—I should explain here that the project now submitted is very much larger than was at first contemplated. It is necessary to mention this, otherwise Government will not understand how the detailed estimate amounts to Rs. 211,298 while I reported last year that the work could be carried out for Rupees 80,000. It was originally intended to irrigate about 7,000 acres only, but the project now submitted will irrigate 18,000 acres, and the masonry works are designed rather larger than the Canal, in order to admit an increase to the supply of water hereafter, without our having to undergo much extra expense. I may also mention here that Mr. Griffith's estimate has been corrected from Rupees 2,00,696 to Rupees 211,298 in this office.

8.—Provision has been made in the Imperial Budget for 1865-66 for this work, but it would be a great matter if Government could sanction a sum of Rupees 20,000 to be expended during the current year, as this would enable us to seize upon the most favorable period of the year to get in the foundations of the weir and com-

mence other masonry works which might afterwards be continued without difficulty during the rains. I fear that unless a commencement of this work can be at once sanctioned the allotment for the coming year cannot be of much use till October next.

I have the honor to be,

Sir,

Your most obedient servant,

J. G. FIFE, Lieut. Colonel, R. E.

Superintending Engineer for Irrigation.

NOTES ON SOME OF THE DETAILS OF PLANS.—BY THE SUPERINTENDING ENGINEER FOR IRRIGATION, (LIEUT. COLONEL FIFE, R. E.)

THE Section of the weir is amply strong enough, but the top is not quite enough rounded to be secure from injury from a tree rolling over it. This can be remedied during the construction. It would also be better to give the weir a slight batter on the down-stream side instead of the up-stream. The face work will be close jointed and no injury will occur, therefore when a very small quantity of water is passing over the weir. When there is any considerable quantity the water will shoot quite clear of the face of the wall.

2. The simple kind of sluice at the head of the Canal will answer, as the greatest head of water will only be 6 feet. Square baulks will, however, have to be substituted for the planks, as the latter under such a head would be unmanageable.

3. The escapes must be arched over as it is found most dif-

ficult to close them when they are simple notches, though they answer in that form when the depth of water does not exceed 1½ or 2 feet.

J. G. FIFE, Lieutenant Colonel, R.E.,
Superintending Engineer for Irrigation.

No. 11 OF 1865

Ahmednuggur, 4th January 1865.

FROM F. GRIFFITH, Esq., Ex. Engineer for Irrigation,

To Lieutenant Colonel J. G. FIFE, R. E.,

Superintending Engineer for Irrigation.

PUBLIC WORKS DEPARTMENT,

Office of the Ex. Engineer, Irrigation.

SIR,—I HAVE the honor to submit for your consideration and approval plans and estimates amounting to Rs. 2,00,696 for the construction of a weir with the necessary head works on the River Paihra, about a mile below the village of Lakh in the Rahooree Talooka of the Ahmednuggur Collectorate, and from thence of an irrigating canal winding parallel to the general course of the river for a distance of 21 miles into the foot of the Rivers Paihra and Godavery.

2. The Lakh irrigation project was originally proposed in 1861 by Captain Finch, R. E., who was then Executive Engineer of these districts, but on a very much smaller scale and with a prospect of a less favorable result, than may be expected from the scheme. I have now the honor to submit a cursory survey and a very rough estimate only appear to have been made of the original project, and a total absence of hench marks on the field, and of plans or field books rendered it necessary to recommence the investigation from the very beginning.

3. On being appointed to the irrigational charge of the Ahmednuggur Collectorate in September last, I at once proceeded by your direction to make the surveys necessary for the project, after completing which, press of business compelled me to defer till the comparative leisure afforded by the monsoon, the formation of the plans and estimates necessary to bring the matter to a conclusion.

4. The volume of water brought down by the Paihra river varies considerably with every month in the year. In the monsoon the stream fed from its sources in the Western Ghats is very large, and nearly independant of local rain, which in a part of the country that frequently suffers severely from failure of the monsoon is a favorable point for consideration in the present scheme. Owing to the cold weather the usual supply is still large, though variably, having been guaged by Captain Finch to be in March 18th at 39 cubic feet per second, and by yourself in December 1862 105 feet, whilst in the middle of October last, during a slight fresh, I approximately estimated the discharge at 450 feet.

5. From information carefully collected from villagers on the banks of this river it may fairly be assumed that even in the dry months of March, April and May, a supply of 20 feet may be confidently expected, though to guard against the slightest chance of over estimating the profits, and to allow a margin for consumption and wastage at villages, I have calculated only 15 cubic feet as available for perennial cultivation, for the months during which water is required for rubbee crops. I am, I believe, within the mark in setting down a supply of 36 feet per second in addition, whilst during the monsoon a much larger supply would be available than is required for the land under command, but if it is found that monsoon irrigation is appreciated by the ryots, a canal can at any time be opened on the right bank of the river.

6. The perennial supply, counted on is, it will be observed, small, as must generally be the case with rivers rising in the Western Ghats, and following eastwards. There is, however, a considerable stream available up to the end of February, and frequently heavy showers falling in April and May increase the sup-

ply considerably for several days at a time. From the local nature of these rivers they can only be made generally useful by the formation of irrigational works like that under consideration.

7. The land available for irrigation by natural flow in the Lakh project is estimated at 39 square miles, or 25,000 acres, while the water supply calculated on the before mentioned data is sufficient to irrigate a still larger area. But allowing 8,000 acres to lie fallow each year, by rotation, the following statement will shew that the calculations have been made on a much smaller area, which will leave a supply of water available for watering monsoon crops by motes or scoops which would probably be eagerly taken advantage of by the ryots in most seasons, as frequently but little rain falls in the early monsoon in this neighbourhood.

Table Shewing Cultivation anticipated.

15 cubic feet per second for 12 months for sugar-cane crops at 100 acres per foot per second	1,500
36 cubic feet per second for four months for rubbee crops at 150 acres per foot per second.....	5,400
101 cubic feet per second for four months for monsoon crops at 100 acres per foot per second.....	10,100
Annual cultivation..... acres	17,000

8. I have calculated the net revenue to be expected from the Lakh irrigation project on data which appear to me to give ample margin for unforeseen contingencies, as well as for incidental expenses, that though foreseen cannot yet be accurately estimated.

Table of Revenue.

1,500 acres	perennial	cultivation	at Rs. 4 per acre.....	6,000
5,400 do.	Rubbee	do.	at Rs. 3 per do.....	16,200
10,100 do.	Monsoon	do.	at Rs. 2 per do.....	20,200
			Total.....	42,400

Deduct cost of maintaining works and supervision 5 per cent on the amount of the estimate..... 10,035

Net Revenue Rs... 32,365

From the above table it will be seen that after making ample allowance for repairs and the current expenses of management, the net Revenue to be expected is 16 per cent on the whole outlay.

9. I cannot help remarking whilst considering this part of the subject on the exceedingly low rate charged by Government as water assessment. From information carefully gleaned from the villagers in this neighbourhood, who variously state the net profit to be derived from an acre of sugar-cane irrigated by motes at from Rs. 100 to Rs. 200, according to the nature of the soil, and the means at the disposal of the cultivator. I learn that with the prices at present prevailing, and with regard to the excellent quality of the soil irrigable by the proposed canal, were the supply of water for perennial irrigation divided amongst the different villages and put up to auction as much as from Rs. 20 to Rs. 30 per annum would be freely obtained, per acre, for water sufficient to irrigate sugar-cane, the gross produce from which is said to be from Rs. 300 to Rs. 400. I beg, therefore, most earnestly to urge the necessity of a re-consideration of the whole question of water-rates, and to state that in my humble opinion the sale of water by auction would be no greater infringement of existing rights than the public auction of waste lands; indeed I believe it would be a boon to the ryots, and would stimulate them by degrees to introduce an improved system of agriculture.

10. It remains briefly to notice the nature of the works provided for in the estimate that accompanies this report. The weir itself will have a total mean length of 1,500 feet, and its height in the deepest part of the River bed will be 15½ feet. The crown of the dam is 3.14 feet above ordinary and 1.66 below extraordinary flood line, but it will cause the afflux of only 4¼ feet in the latter case on account of the great length of overfall. No damage is likely to be done to the villages above the dam site even in

very high floods. The flanks of the weir will be protected by wing walls and embankments to a height of 10 feet above the highest known flood line, or 7 feet above what the same flood would be were the weir erected. On the right flank a breast wall is added to protect a soft part of the bank, immediately below the weir, which it is advisable to preserve uninjured.

11. The water will enter the canal through a regulating head of 2 arches of 7 feet span and four feet high to springing, small enough to be easily managed, they will be closed by teakwood planks dropped singly into grooves on the face of the arches. They will be furnished with stout hooks at each end so that they can easily be raised by iron rods.

12. The Channel will pass from the head through a short rock cutting into a small valley where it will at once begin to irrigate and will have the sections shewn in the following table:—

Table of Sections of Canal.

Miles.	Width at bottom.	Depth.	Fall per Mile.	Discharge per second.	Tide slopes.		
From 1st to 3rd Mile.....	14	4	1	182.4	1½	to	1
Ditto 4th to 6th ditto... ...	13	4	1	149.7		Do.	
Ditto 7th to 10th ditto.... ...	12	3½	1½	140.2		Do.	
Ditto 11th to 13th ditto.... ...	11	3½	1½	130.8		Do.	
Ditto 14th to 16th ditto... ...	10	3½	1½	121.5		Do.	
Ditto 17th to 18th ditto... ...	9	3½	1½	102.3		Do.	
Ditto 19th to 20th ditto... ...	8	3	2	92.9		Do.	
Ditto 21st to end of canal.....	8	3	2	92.9		Do.	

Approximate quantities are given of moorum and rock cutting which will also occasionally be met with, but it was impossible without spending much more time than I had at my disposal, to determine accurately the quantities of each kind of soil likely to

be met with. As it is considered sufficiently certain that monsoon cultivation will be very largely in request, it has been thought best to add 25 per cent to the width of the aqueducts and bridges at once, leaving the canal to be widened if required. As the supply of water that would be available in the monsoon, if required, would be very much larger than that for which the canal is designed and a great deal of land above the canal level would be irrigable by means of motes or scoops.

13. On the whole length of 21 miles of canal the following masonry works will be required :—

Bundura.

With head work wing breast and screen walls.

Aqueducts

2 of 1	arches of	10 feet	span	$17\frac{1}{4}$ breadth at bottom.
1 of 6	ditto	do.		$16\frac{1}{4}$ ditto.
3 of 1	ditto	do.		$16\frac{1}{4}$ ditto.
4 of 1	ditto	do.		15 ditto.
1 of 2	ditto	do.		15 ditto.
2 of 1	ditto	do.		$13\frac{3}{4}$ ditto.
1 of 4	ditto	do.		$13\frac{3}{4}$ ditto.

2 of one arch of 10 feet span, $12\frac{1}{2}$ feet broad at bottom.

Escapes.

one escape of 2 openings 2 feet wide 4' deep.
Three do. do. 2 ,, 3 ,,
one do. 3 do. 2 ,, 3 ,,

3. Communication bridges of 32 feet span.
5. Ditto ditto 25 ditto.
2. Ditto ditto 22 ditto.

25 Regulators for branch canals.

Bungalow.

One two roomed bungalow with out-houses.

14. The mode of distribution at the heads of branch canals is left for further consideration, but calculating a branch at about every $\frac{3}{4}$ of a mile, allowance is made in the estimate of 25 Regulators, which I think will be found quite sufficient.

15. A small bungalow is also provided for in the estimate, as it is necessary that an Executive Officer should reside on the spot during the construction of the works, and a competent superintendant afterwards. This might be erected near the village of Bardapoor being a healthy and central position.

16. In concluding my report I trust I may be allowed to state that in my humble opinion there is in the Lakh scheme every favorable point usually looked for in such a project:—Good land, source of water independant of local supply; inexpensive line of country, with a total absence of heavy cuttings, masonry works or any other engineering difficulties whatever.

17. Irrigational schemes are presented just now under the double disadvantage of unprecedented high cost of construction and exceedingly low rates of water assessment. Were the present scheme to be estimated on the rates of construction prevailing five years ago, when the water rate was as high as it is now, I am convinced the net revenue to be derived would not fall short of 50 per cent., a profit that I venture to say may still be expected if the water assessement be raised to correspond in some slight degree with the increased price obtained by the ryot for his labour and produce.

18. Should you obtain the sanction of Government, as I trust you will, to the immediate commencement of this work, I shall be prepared to break ground at the shortest notice, and a grant of Rs. 60,000 will enable me in the current year to lay the foundation of the weir, complete the wing walls and head works, and do so much of the earth work that I should be in a position, I trust, to complete the work in the year following.

I have the honor to be,

Sir,

Your most obdt. servant,

F. R. GRIFFITHS, R. E.,

Ex. Engineer for Irrigation, A. & N.

No 1779 OF 1864.

Ahmednuggur, 3rd September 1864.

FROM W. D'OYLY, Esq., Collector of Ahmednuggur,

To Lieutenant Colonel J. G. FIFE, B. E.,
Superintending Engineer for Irrigation,

POONA,

Ahmednuggur, Collector's Office.

SIR,—HAVING been requested by the Executive Engineer for Irrigation to express my opinion regarding the Lakh scheme, I have the honor to state, without entering into the professional details, that if it is allowed that it pays to irrigate by damming rivers, the scheme under consideration must answer, if properly carried out, as all the requisite natural facilities are there at hand.

2. I will now enter upon the subject of the rates. I entirely agree with the Executive Engineer that the water rates on which his calculations are based are much too low, so much so that by imposing such rates I consider that we are wantonly throwing away the resources of Government. I do not, however, agree with the Executive Engineer that it is advisable to put the water up to auction, such course is open to two objections, the villagers may bid spitefully against each other and ruin themselves by agreeing to pay too high rates, or they may combine in order to lower the rates. I think the rates should be fixed authoritatively once for all.

3. I think the following would be very moderate rates: Rupees 9 for perennial irrigation, Rupees 5 for cold weather, and Rupees 3 for monsoon irrigation. Taking the Executive Engineer's figures as to the amount of land which will be irrigated the returns will be as follows:—

1,500 acres perennial irrigation at Rupees 9...	13,500
5,400 cold weather at Rupees 5.....	27,000
	40,500

which after deducting 5 per cent. for expenses gives nearly 18 per cent. on the outlay.

Add 10,100 Monsoon irrigation at Rupees 3...	30,300
	70,800

which gives after making the necessary deductions upwards of 30 per cent. on the outlay.

4. I have purposely separated the monsoon from the fair weather irrigation, as I think doubtful whether the Cultivators will at first be very willing to grow crops which require irrigation during the monsoon: I have no doubt, however, that they will do so after a time, but some years will probably elapse before the whole amount calculated is realized.

5. The rates I have proposed will of course have to be considered by the Revenue Commissioner and by Government. I think I have written enough to show that the scheme must yield a fair return and that there is a fair prospect of the returns being very large indeed.

I have the honor to be,
Sir,
Your most obedient servant,
W. D'OYLY,
Collector.

III. PUBLIC IMPROVEMENT.

K.—AGRICULTURAL.

1. Irrigation Canal.

PUBLIC WORKS DEPARTMENT.—*Ahmednuggur Collectorate.*

No. 5 OF 1864-5.

Estimate framed by F. R. Griffith, Esquire, Executive Engineer for Irrigation A. and N., of the probable cost of constructing a Bundara across the river Paihra, with irrigating canal including

the necessary aqueducts, bridges and escapes, estimate framed agreeably to instructions contained in Government Resolution, No. 2365 of 26th November 1863 received under Superintending Engineer for irrigation, endorsement, No. 751 of 14th December 1863, amounting to

Rupees... 2,11,298 0 0

GENERAL DESCRIPTION.

Bundara across the river Paihra and head works.

The Bundara to be 1500 feet mean length and 8 feet in width at the top to allow of a temporary earthen bund being erected on it in the dry season, to pond up the water above the weir with a batter of 2 in 15 on the up stream side, making the mean thickness equal 60 of the height. Its position and direction is so laid out as to secure a foundation throughout on solid rock. The south end of the Bundara to be raised 2 feet above the north end to turn the water freely towards the canal mouth, and to save the south bank from floods.

The greatest height of the weir will be 15·5 feet above the bed of the river, on the right and left banks screen walls will be built 600 feet in length, having a top width of 3 feet with an offset of 8 inches every 2½ feet of depth and rising to a height of 7 feet above the highest flood known, after allowing for the afflux calculated for that height of flood, these screen walls are flanked by earthen embankments carried on at 2 feet above the height of the screen wall to the high ground beyond.

The steep bank on the right flank is further protected by a wing wall on the down stream-side of the weir, 150 feet in length, of the same height as the screen walls.

The head works consist of 2 regulating arches in the wing wall of the left bank 7 feet in width, and 4 feet up to springing which will be closed by strong teakwood planks dropped singly into grooves cut in the cutwaters of the pier and abutments, the canal for the first 200 feet after leaving the regulator will be furnished with a breast and screen wall, which, in the event of the regulator being accidentally left open during a fresh will act as an

escape weir of this length, and prevent injury to the canal from any rush of water.

The weir head work wing and breast walls, all to be formed of good large coarsed rubble masonry, the faces of all works exposed to action of water to be of large stone carefully hammer dressed, so that no wide joints may be left.

The foundation to be laid of the same material as the superstructure, and none but good hydraulic lime to be used and the whole superstructure to be well pointed.

Six scouring sluices 4 by 2 to be placed two near each end of the weir as per plan, and 2 in the canal to be closed with teak planks. All planks for sluice gates to be of well seasoned teak wood in planks one foot in width 3" thick fitted with strong iron hooks for the convenience of raising and lowering.

All grooves and faces for shutters to be of cut stone, dressed 2nd sort.

Earth Embankments to be raised in layers, watered and rammed 1 foot at a time.

Every thing to be constructed in accordance with the plans and estimates as they may be sanctioned.

MEASUREMENTS.

	Number.	Length.	Breadth.	Height.	SOLID FEET.
Excavation in Moorum and Black soil.					
Screen wall Right side 1st portion...	1	100	4·5	5·5	21175
„ 2nd „	1	100	4·83	6·20	2994·60
„ 3rd „	1	100	5·33	8	4264
„ 4th „	1	100	5·5	11·20	6160
„ 5th „	1	100	5·83	12	6996
Screen left side 1st portion.....	1	335	13	4	1742
„ 2nd „	1	65	5·5	4	1430
„ 3rd „	1	240	4·83	4·5	5216·40
„ 4th „	1	265	4·17	3·5	3867·67
Bundara right side 1st portion.....	1	180	10·60	13	24804
„ 2nd „	1	40	10·80	5·5	2376
„ 3rd „	1	100	11	2·80	3080
„ 4th „	1	20	10·80	1·5	324
„ 5th „	1	40	10·90	1	436
Carried over.....	.....	.....	.....	.....	66165·67

Excavation in Moorum and Black soil—(continued.)	Number.	Length.	Breadth.	Height.	Solid Feet.
Brought over					63165·67
Bundara left side 1st portion	1	25	9·70	2	485
„ 2nd „	1	16	9·90	3	475·20
„ 3rd „	1	20	10·30	5	1030
„ 4th „	1	18	10·20	7	1285·20
„ 5th „	1	125	10·5	7·5	9843·45
„ 6th „	1	23	10·20	5·5	1290·30
„ 7th „	1	23	10	4·70	1081
„ 8th „	1	27	9·80	4·20	1111·32
„ 9th „	1	108	9·60	5	5184
„ 10th „	1	140	9·70	6	8148
„ 11th „	1	32	9·40	4·40	1323·52
„ 12th „	1	27	9·30	3·5	878·85
„ 13th „	1	130	9 10	3·5	4140·5
„ 14th „	1	42	9·20	6	2318·40
Wing walls	1	150	5·83	12	10494
Breast walls	2	200	4·33	9	15588
Solid feet excavation in Moorum and Black soil					130842·71

Excavation in Rock.	Number.	Length.	Breadth.	Height.	Solid Feet.
Bundara 1st portion	1	180	10·10	1·80	3272·40
„ 2nd „	1	40	10·30	2·20	906·40
„ 3rd „	1	100	10·5	2	2100
„ 4th „	1	20	10·30	1·90	391·40
„ 5th „	1	40	10·40	2	832
„ 6th „	1	20	10·30	2·20	453·20
„ 7th „	1	40	10·5	2·20	924
„ 8th „	1	80	10·5	2	1680
„ 9th „	1	20	9·90	2·5	495
„ 10th „	1	20	9·80	2	392
„ 11th „	1	20	9·90	3·20	633·60
„ 12th „	1	140	10·20	2·20	3141 60
„ 13th „	1	20	9·90	2·5	495
„ 14th „	1	40	9·70	2	776
„ 15th „	1	20	9·30	3	558
„ 16th „	1	25	9·20	2	460
„ 17th „	1	16	9·40	2·5	376
„ 18th „	1	20	9·80	2·5	490
„ 19th „	1	18	9·70	2·5	436.5
„ 20th „	1	120	10	2	2400
„ 21st „	1	23	9·70	3	669·30
Carried over					21880 95

Excavation in Rock.— (continued.)	Number.	Length.	Breadth.	Height.	Solid feet.
Brought over....	..	..	..	..	21,880·95
Bundara 22rd portion..	10	23	9·5	2	437
„ 23rd „	1	27	9·30	2·20	552·42
„ 24th „	1	108	9·10	2	1,965·60
„ 25th „	1	142	9·20	2·20	2,874·08
„ 26th „	1	32	8·90	2	569·60
„ 27th „	1	27	8·80	2	475·20
„ 28th „	1	130	8·60	2·30	2,571·40
„ 29th „	1	42	8·70	2	730·80
Screen-wall left side, 1st portion.....	1	335	13	·80	348·40
„ 2nd „	1	65	4·83	·80	251·16
Breastwalls.....	2	200	3·83	2	3,064
Solid feet excavation in Rock..					35,720·01

Filling in Foundation.	Solid feet.
Same as Excavation in rock.....	35,722·06
Solid feet filling in foundation..	35,722·06

Superstructure.	Number.	Length.	Breadth.	Height.	Solid feet	Solid feet.
			mean.			
Bundara 1st portion	1	180	8·80	12	19,008	
„ 2nd „	1	40	8·90	13·40	4,770·40	
„ 3rd „	1	100	9	14·70	13,230	
„ 4th „	1	20	8·90	13·60	2,420·80	
„ 5th „	1	40	8·95	14·30	5,119·40	
„ 6th „	1	20	8·90	13·25	2,358·5	
„ 7th „	1	40	9	14·80	5,328	
„ 8th „	1	80	9	14·5	10,440	
„ 9th „	1	20	8·70	10·30	1,792·20	
„ 10th „	1	20	8·65	9·5	1,643·5	
„ 11th „	1	20	8·70	10·30	1,792·20	
„ 12th „	1	140	8·85	13	16,107	
„ 13th „	1	20	8·70	10·13	1,762·62	
„ 14th „	1	40	8·60	9	3,096	
„ 15th „	1	20	8·40	5·90	991·20	
„ 16th „	1	25	8·35	5·5	1,148·12	
Carried over....	..	..	..	..	91,007·94	

Superstructure.—(continued.)	Number.	Length.	Breadth.	Heigth.	Solid feet.	Solid feet.
Brought over.....	..	..	..	..	91,007·04	
Bundara 17th portion..	1	16	8·45	6·70	905·84	
„ 18th „	1	20	8·65	8	1,384	
„ 19th „	1	18	8·60	9·40	1,455·12	
„ 20th „	1	125	8·75	11	12,031·25	
„ 21st „	1	23	8·60	8·80	1,740·64	
„ 22nd „	1	23	8·5	7·40	1,446·70	
„ 23rd „	1	27	8·90	5·80	1,393·74	
„ 24th „	1	108	8·80	4·40	4,181·76	
„ 25th „	1	142	8·35	5	5,928·5	
„ 26th „	1	32	8·20	2·80	734·72	
„ 27th „	1	27	8·15	2	440·10	
„ 28th „	1	130	8·5	·80	884	
„ 29th „	1	42	8·10	1·5	510·30	
Triangular Portion over Bundara.	2	24·25	8· mean.	12	4,656	
Screen-wall right side 1st portion.	1	100	3·5	10	3,500	
„ 2nd „	1	100	3·66	12·25	1,174·5	
„ 3rd „	1	100	3·93	14·5	5,698·5	
„ 4th „	1	100	4·60	16·60	7,360	
„ 5th „	1	100	4·53	19·20	8,697·60	
Right Abutment.....	1	12 mean.	8	4	384	
Left. „	1	12	7·5	4	360	
Pier.....	1	9·5	3	4	114	
Cut-water Triangular..	1	1·30	3	7	27·30	
„ Semicircular.....	1	..	3·53 area.	7	24·71	
Masonry over Pier and abutment.	1	33·5	9·5	11·5	3,659·87	
Left side screen-wall 2nd portion.	1	65	4	15·20	3,952	
„ 3rd „	1	240	3·66	8·90	7,817·76	
„ 4th „	1	265	3·33	5·80	5,118·21	
Wing-wall.....	1	150	4·53	19.20	13,046·40	
Breast-walls..	2	200	3·16	3·5	4,424	
Curved portion on the right screen-wall.....	1	600	..	1 area.	612	
„ Triangular Pier.....	2	51·5	..	2 69 area.	277·07	
„ on Bundara.....	1	1450	..	2·69 area.	39	
Screen-wall left side 1st portion.	1	33·5	..	3·176 area.	106·39	
„ 2nd „	1	570	..	1·02 area.	561·40	
„ over-wing wall.	1	150	..	1·02 area.	153	
„ Breast wall....	2	200	..	1·02	408	
						196,216·42
Carried over....	..	..	..	..	....	196,215·42

Superstructure.—(continued)	Number.	Length.	Breadth.	Height.	Solid feet	Solid feet.
Brought over.. ..	..	..	..	..	...	1,96,216·42
Deduct Archways....	2	9·5	..	7·24 area.	137·56	
Sluices.....	6	9	4	2·	432	
Arches over sluices.....	6	9	..	12·57 area.	678·78	1,248·34
				Solid feet Superstructure..		197,463·76

Earthwork.	Number.	Length.	Breadth.	Depth.	Solid Feet.
Right side embankment 1st portion..	1	320	mean 17·85	mean 3·14	17,935·68
„ „ 2nd „ ..	1	100	mean 27·5	7	19,250
„ „ 3rd „ ..	1	100	mean 33·37	mean 9·35	31,200·95
„ „ 4th „ ...	1	100	mean 40	mean 12	48,000
„ „ 5th „ ..	1	100	mean 35·20	mean 10·08	35,481·60
„ „ 6th „ ..	1	100	mean 17·82	mean 7·82	55,740·96
Left „ „ 1st „ ..	1	550	mean 17·5	mean 7·5	72,187·5
„ „ 2nd „ ..	1	565	mean 33·5	mean 9·40	177,918·5
„ „ 3rd „ ..	1	400	mean 25	mean 6	60,000
				Solid feet Embankment..	517,715·19

Woodwork.	Number.	Length.	Breadth.	Height.	Solid Feet.
Plank fitted in gates	2	8	·25	7	28
„ „	6	5	·25	7	52·5
				Solid feet Teakwood work..	80 5

Iron Work.	Number.
Iron Work	16
No. of Iron Work.....	16

ABSTRACT.

		Rs. a. p.
130,842·71	Solid feet excavation in Moorum and black soil at Rs. 1-0-0 per 100 solid feet	1,308 6 8
35,722·06	Solid feet excavation in rock at Rs. 8-0-0 per foot	2,857 12 2
35,722·06	Solid feet filling in foundation with rubble stone and lime masonry at Rs. 20-0-0 per foot..	7,144 6 7
194,967·98	Solid feet superstructure with rubble stone and lime masonry at Rs. 20-0-0 per foot..	38.993 9 6
517,715·19	Solid feet earth embankment at Rs. 0-12-0 per foot.. ..	3,882 13 10
80·5	Solid feet wood work at Rs. 4-0-0 per foot.	322 0 0
16	No. iron hooks at Rs. 0-12-0 each..	12 0 0
		54,521 0 9
	Contingencies at 5 per cent...	2,726 0 10
	Extra Establishment.	
2	Carcoons at Rs. 10 per month for two years 480 0 0	
4	Muccadums at Rs. 8-0-0 „ 768 0 0	
2	Chowkeedars at Rs. 6-0-0 „ 288 0 0	1,536 0 0
	Total Rs..	58,783 1 7

CANAL.

Specification.

The canal to be 21 miles and 600 feet in length, and to be divided into the following sections:—1st portion from the 1st to the 3rd mile to be 14 feet broad at bottom and four feet deep; 2nd portion from the 3rd to the 6th mile to be 13 feet broad at bottom and four feet deep; 3rd portion from 6th to 10th mile to be 12 feet broad at bottom and 3½ feet deep; 4th portion from the 11th to the 13th mile to be 12 feet broad at bottom and 3½ feet deep; 5th portion from the 14th to the 16th mile to be 10 feet broad at bottom and 3½ feet deep; 6th portion from the 15th to the 18th mile to be 9 feet broad at bottom and 3½ feet deep; 7th portion from the 19th to the 20th mile to be 8 feet broad at bottom and 3 feet deep; 8th portion from the 21st mile to the end of the canal to be 8 feet broad at bottom and 3 feet deep.

The side slopes for Rock cuttings to be 6″ to one, and for Moorum 1 to 1 and for soil 1½ to 1.

All embankments to be raised in one foot layers, watered and rammed with an outside slope of 20 to one, and a berm on each side to be formed 10 feet wide from the edges of canals, and the spoil earth to be formed into embankment outside of this berm.

The banks are to be made 3 feet above highest water level, wherever water line comes much above level of ground.

MEASUREMENT.

Earth Work Excavation.	Number.	Length.	Breadth.	Height.	Solid Feet.	Solid Feet.
1 *Mile.*						
1st Portion	1	800	16·75	5	67,000	
2nd „	1	1,000	20·37	9·75	198,607·5	
3rd „	1	1,000	16·62	7·75	128,800	
4th „	1	1,000	2·15	5	107,500	
5th „	1	1,000	21·12	4·75	100,320	
6th „	1	1,000	27·27	8·85	241,339·5	
7th „	1	280	31·77	11·85	105,412·86	
						948,979·86
2 *Miles.*						
1st Portion	1	720	30·52	10·75	236,224·80	
2nd „	1	1,000	31·37	10·75	337,227·5	
3rd „	1	1,000	33·32	11·30	393,176	
4th „	1	1,000	30·40	10·10	307,040	
5th „	1	1,000	28·76	9·00	258,340	
6th „	1	560	27·94	7·71	120,633·7	
						1,652,642·00
3 *Miles.*						
1st Portion	1	700	24·87	7·25	126,215·25	
2nd „	1	1,000	21·87	5·25	114,817·5	
3rd „	1	1,200	20·52	4·35	107,114·40	
4th „	1	600	20·30	4·20	51,156	
5th „	1	700	19·02	3·35	44,601·90	
6th „	1	1,080	18·87	3·25	66,233·70	
						510,138·75
4 *Miles.*						
1st Portion	1	1,000	20·25	3·5	617,625	
2nd „	1	1,000	21	4	84,000	
3rd „	1	1,000	19·5	3	58,500	
4th „	1	1,000	17·87	3·25	58,077·5	
5th „	1	1,000	17·12	2·75	47,080	
6th „	1	280	17·12	2·75	13,182·40	
						878,464·90
Carried over...	..	...	..	..	....	3,9(0,225·51

Measurement.	Number.	Length.	Breadth.	Height.	Solid Feet.	Solid Feet.
Earth Work Excavation.—(contd.)						
Brought over..	..	..	..	..	....	3,990,225·51
5 *Miles.*						
1st Portion	1	600	18·25	3·5	38,325	
2nd ,, ...	1	1,000	18.25	3·5	63,875	
3rd ,, ...	1	1,200	17.5	3	63,000	
4th ,, ...	1	900	18·25	3·5	57,487·5	
5th ,, ...	1	500	18·25	3·5	31,937·5	
6th ,, ...	1	600	17·87	3·25	34,846·5	
7th ,, ...	1	480	5·57	3·75	10,026	
						299,497·5
6 *Miles.*						
1st Portion	1	480	19.37	4·25	39,514·80	
2nd ,, ...	1	550	18·02	3·35	32,201·85	
3rd ,, ...	1	600	16·97	2·65	26,982·30	
4th ,, ...	1	1,100	10·55	2·37	43,145·85	
5th ,, ...	1	600	15·80	1·87	17,727·60	
6th ,, ...	1	1,100	16·85	2·30	41,618·5	
7th ,, ...	1	850	17·12	2.75	30,018	
						231,208·90
7 *Miles.*						
1st Portion	1	900	14·80	1·87	24,908·40	
2nd ,, ...	1	600	15·40	2·27	20,974·80	
3rd ,, ...	1	800	16·72	3·15	42,134·40	
4th ,, ...	1	1,200	16·87	3·25	65,793	
5th ,, ...	1	300	15·67	2·45	11,517·45	
6th ,, ...	1	900	15·60	2·40	33,696	
7th ,, ...	1	580	17·17	3 45	34,337·17	
						233,361·22
8 *Miles.*						
1st Portion	1	550	17	3·37	31,509·5	
2nd ,, ...	1	1,150	16·87	3·25	63,050	
3rd ,, ...	1	850	16·68	3·12	44,235·36	
4th ,, ...	1	850	18·55	4·37	68,903·97	
5th ,, ...	1	1,000	18·15	4·10	74,415	
6th ,, ...	1	880	15·70	2·47	34,125·52	
						316,239·35
9 *Miles.*						
1st Portion	1	320	15·75	2·5	12,600	
2nd ,, ...	1	1,200	13·87	1·25	20,805	
3rd ,, ...	1	1,200	14·47	1·65	28,650·60	
4th ,, ...	1	600	16·72	3·15	31,600·80	
5th ,, ...	1	300	18·45	4 30	23,800·5	
6th ,, ...	1	1,360	19·70	3 80	116,781 60	
						234,238·50
Carried over.	..	..	..	..	....	5,304,770·98

Measurement.	Number.	Length.	Breadth.	Height.	Solid Feet.	Solid Feet.
Earth work Excavation.—(contd.)						
Brought over....	..	..	..	..	....	5,304,770·98
10 *Miles.*						
1st Portion	1	1,100	17·80	3·87	75,774·60	
2nd „	1	1,000	17·43	3·62	63,096·60	
3rd „	1	1,000	17·73	3·82	67,728·60	
4th „	1	1,000	19·05	4.70	89,535	
5th „	1	1,000	19·98	3·32	66,333·60	
6th „	1	180	19·35	2·90	10,100·70	
						3,72,569·10
11 *Miles.*						
1st Portion	1	900	17·30	4·20	65,394	
2nd „	1	600	17·75	4·5	47,925	
3rd „	1	1,000	17·75	4·5	79,875	
4th „	1	1,000	17·18	4·12	70,781·60	
5th „	1	1,000	16·80	3·87	65,016	
6th „	1	780	17·18	4·12	55,209·64	
						3,84,201·24
12 *Miles.*						
1st Portion	1	1,200	18·5	3	66,600	
2nd „	1	1,000	18·65	3·10	57,815	
3rd „	1	1,000	19·40	3·60	69,840	
4th „	1	1,000	18·68	3·12	58,281·60	
5th „	1	1,080	17·75	4·59	86,265	
						3,38,801·60
13 *Miles.*						
1st Portion	1	1,400	18·80	3·87	1,01,858·40	
2nd „	1	1,000	17·12	2·75	47,080	
3rd „	1	900	14·85	2·57	34,348·05	
4th „	1	900	10·05	2·70	36,571·5	
5th „	1	1,080	15·5	3	50,220	
						2,70,077·95
14 *Miles.*						
1st Portion	1	650	15·25	3·5	34,693·75	
2nd „	1	1,000	16	4	64,000	
3rd „	1	1,000	16	4	64,000	
4th „	1	1,200	14·30	2·87	49,249·20	
5th „	1	1,430	14·5	3	62,205	
						2,74,147·95
Carried over..	..	..	..	..	.....	6,954,568·82

Measuremnt.	Number.	Length.	Breadth.	Height.	Solid Feet.	Solid Feet.
Earth work Excavation.—(contd.)						
Brought over						6,954,568·82
15 *Miles.*						
1st Portion	1	800	16·68	3·12	46,837·44	
2nd „	1	1,000	17·25	3·5	60,375	
3rd „	1	750	17·62	3·75	49,556·25	
4th „	1	1,400	16·37	4·25	97,401·5	
5th „	1	1,230	14·5	3	53,505	
						307,675·19
16 *Miles.*						
1st Portion	1	800	13·37	2·25	27,074·25	
2nd „	1	1,000	14·30	2·87	41,041	
3rd „	1	1,000	15·05	3·37	50,718·5	
4th „	1	1,000	14·87	3·25	48,327·5	
5th „	1	480	14·80	3·20	22,732·80	
6th „	1	380	14·80	3·20	22,732.80	
7th „	1	520	14·5	3	22,620	
						235,246·85
17 *Miles.*						
1st Portion	1	650	14·82	3·55	34,197·15	
2nd „	1	1,000	14·82	3·55	52,611	
3rd „	1	1,000	13·87	3·25	45,077·55	
4th „	1	1,000	14·80	3·87	57,276	
5th „	1	1,000	15·63	4·42	69,084·60	
6th „	1	630	14·43	3·62	32,909·05	
						291,155·30
18 *Miles.*						
1st Portion	1	500	16·43	3·62	29,738·30	
2nd „	1	1,000	15·87	3·25	51,577·5	
3rd „	1	900	13·85	2·90	36,148·5	
4th „	1	1,000	13·92	2·95	41,064	
5th „	1	1,000	14·25	3·5	49,875	
6th „	1	880	15·07	4·05	53,709·48	
						262,112·78
19 *Miles.*						
1st Portion	1	1,000	13·82	3·55	49,061.	
2nd „	1	950	14·62	3·75	52,083·75	
3rd „	1	950	14·62	3·75	52,083·75	
4th „	1	1,000	15·00	4	60,000	
5th „	1	1,000	14·70	3·80	55,860	
6th	1	380	14·40	3·60	19,699·20	
						288,787·70
Carried over						8,339,546·64

Measurement.	Number.	Length.	Breadth.	Height.	Solid feet.	Solid feet.
Earth work Excavation.—(contd.)						
Brought over....	..	..	..	..	1,17,464·30	
						8,339,546·64
20 *Miles.*						
1st Portion	1	700	14·70	3·80	39,102·	
2nd „	1	1,000	13·12	2·75	36,080·	
3rd „	1	600	12·75	2·5	19,125·	
4th „	1	900	13·87	3·25	40,569·75	
5th „	1	1,200	13·5	3	48,600·	
6th „	1	880	13·5	3	35,640·	
						2,19,116·75
21 *Miles.*						
1st Portion	1	300	12·95	3·30	12,820·5	
2nd „	1	1,000	13·5	3·67	49,545·	
3rd „	1	1,000	13·25	3·5	46,375·	
4th „	1	1,000	12·30	2·87	35,301·	
5th „	1	1,000	12·12	2.75	33,330·	
6th „	1	980	12·5	3	36,750·	
						2,14,121.5
22 *Miles.*						
1st Portion.....	1	600	12·5	3·	22,500·	
						22,500·
Additional Excavation in side Cuttings to supply Material for banks wherever the Excavation in the Canal itself is insufficient.						
3rd Mile	2	1,200	11·40	4·25	1,16,280·	
5th „	2	1,000	11·40	4·25	96,900·	
8th „	2	800	13·25	5·5	1,16,600·	
9th „	2	1,000	15·	6	1,80,000·	
12th „	2	300	22·5	9	1,21,500·	
14th „	2	600	12·5	5	75,000·	
						7,06,280·
						9,501,564·64
Deduct on account of Aqueducts.....						25,543·
					Solid feet excavation.....	9,476,021·89
Excavation in Moorum.						
1 *Mile.*						
1st Portion	1	800	15	2	24,000·	
2nd „	1	1,000	15	2	30,000·	
3rd „	1	1,000	15	2	30,000·	
						84,000·
Carried over..	..	..	..	..	....	84,000·

	Number.	Length.	Breadth.	Height.	Solid feet.	Solid feet.
Excavation in Moorum.—(contd.)						
Brought over...	...	...	...	..	.....	84,000·
2 *Miles.*						
1st Portion	1	720	16·5	2·5	29,700	
2nd „	1	1,000	16·5	2·5	41,250	
3rd „	1	1,000	16·5	2·5	41,250	
4th „	1	1,000	16·5	2·5	41,250	
5th „	1	1,000	16·5	2·5	41,250	
6th „	1	560	16·5	2·5	41,250	
						2,35,950·
4 *Miles.*						
1st Portion	1	1,000	14	1	14,000	
2nd „	1	1,000	14	1	14,000	
3rd „	1	1,000	14	1	14,000	
						42,000·
9 *Miles.*						
1st Portion	1	1,560	13·5	1	21,060	
						21,060·
10 *Miles.*						
1st Portion	1	1,000	13·5	1·5	20,250	
2nd „	1	180	13·5	1·5	3,645	
						23,895·
12 *Miles.*						
1st Portion	1	1,200	12·5	1·5	22,500	
2nd „	1	1,000	12·5	1·5	18,750	
3rd „	1	1,000	12·5	1·5	18,750	
4th „	1	1,000	12·5	1·5	18,750	
						78,750·
13 *Miles.*						
1st Portion	1	1,400	12	1	16,800	
2nd „	1	1,000	12	1	12,000	
						28,800·
15 *Miles.*						
1st Portion	1	900	11	1	9,900	
2nd „	1	1,000	11	1	11,000	
3rd „	1	750	11	1	8,250	
						29,150·
17 *Miles.*						
6th Portion	1	650	10	1	6,500	
						6,500·
Carriedover..	..	...	..	..	.....	5,50,105·

	Number.	Length.	Breadth.	Height.	Solid Feet.	Solid Feet.
Excavation in Moorum.—(contd.)						
Brought over...	....	....	....	....	....	550,105
18 *Miles.*						
1st Portion	1	500	10	1	5,000	
2nd „	1	1,000	10	1	10,000	
3rd „	1	900	10	1	9,000	
4th „	1	1,000	10	1	10,000	
5th „	1	1,000	10	1	10,000	
6th „	1	880	10	1	8,800	
						52,800
19 *Miles.*						
1st Portion	1	1,000	10	1	10,000	
						10,000
Solid feet excavation in Moorum..						612,905

Rock Cutting.	Number.	Length.	Breadth.	Height.	Solid Feet.
1 *Mile.*					
1st Portion	1	800	15·25	3	36,600
2nd „	1	1,000	16	4	64,000
3rd „	1	1,000	16	4	64,000
Solid feet Rock Cutting..					164,600

Embankment.	Number.	Length.	Breadth.	Height.	Solid Feet.	Solid Feet.
4 *Miles.*						
4th Portion	1	1,000	7·75	1	7,750	
5th „	1	1,000	7·75	1	7,750	
6th „	1	280	7·75	1	2,170	
						17,670
Carried over..	..	..	..	..	.....	17,670

Embankment.—(continued.)	Number.	Length.	Breadth.	Height.	Solid Feet.	Solid Feet.
Brought over....	..	..	...	..	....	17,670
5 Miles.						
2nd Portion	1	600	6·75	·5	2,325	
3rd „	1	1,000	6·75	·5	3,375	
4th „	1	1,200	6·32	·75	5,688	
5th „	1	800	6·43	·25	14,467·5	
						25,855·5
6 Miles.						
2nd Portion	1	550	7·15	·65	2,548·97	
3rd „	1	600	8·36	1·35	6,771·60	
4th „	1	1,100	8·85	1·63	15,868·05	
5th „	1	600	9·72	2·13	12,422·16	
6th „	1	1,100	2·97	1·70	5,553·90	
7th „	1	850	8·18	1·25	8,691·25	
						51,855·93
8 Miles.						
7th Portion	1	880	8·67	1·53	11,673·28	
						11,673·28
9 Miles.						
1st Portion	1	320	6·87	·50	1,099·20	
2nd „	1	1,200	9·01	1·75	18,921·00	
3rd „	1	1,200	8·36	1·35	13,543·20	
						33,563·40
					Solid feet embankment..	140,618·11

Abstract.

96,98,515	Solid feet excavation at Rupees 0-12-0 per 100 solid feet..	72,738	13	9
6,12,905	„ „ in Moorum at Rupees 1-0-0 „ ..	6,129	0	9
1,64,600	„ Rock Cutting at Rupees 8-0-0 „ ..	13,168	0	0
1,40,617	„ Embanking at Rupees 0-6-0 „ ..	527	5	0
	Total...	92,563	3	6
	Contingencies at 5 per cent....	4,628	2	7

Establishment.

4 Carcoons for 2 years at Rupees 10 per month..	960-0-0			
8 Muccadums „ at Rupees 8 „	1,536-0-0			
4 Chowkeedars „ at Rupees 5 „	480-0-0	2,976	0	0
	Total Rupees..	1,00,167	6	1

Afflux caused by the weir calculated from the following formula from Downny's Hydraulic.

$Q = 3.488 L.H \sqrt{H + 0.0349 W^2} + 4.96 L(A-B) \sqrt{H + 0.01 W^2}$ where Q = 77299

mean
„ L = 1500

$77299 = 3.488 \times 1500 \times H \sqrt{H \times 0.0349 \times 6.7657^2} + 4.96 + 1500 + 1.5 \sqrt{H + 0.01 + 6.7657^2}$

where H = to be found

mean velocity after construction of weir.

where W = 1.25 + 5 4126 = 6.7657

$77299 = 5232H \sqrt{H + 1.60} + 11160 \sqrt{H + 0.46}$

where A = 17

where B = 15.5

In this equation the value of H = 4.215 nearly

F. R. GRIFFITH, C. E.,
Executive Engineer for Irrigation.

AQUEDUCT No. 4.

General Description.

The aqueduct to consist of one segmental arch of 10 feet span, 2 feet rise, one foot thick. Abutments to be 3 feet thick; backing over abutments and piers to be carried up to the blocking course, with a layer of 6 inches of concrete on top to render the masonry watertight. Foundations and abutments to be carried down 3 feet in steps of one foot thick, each with 3 inches offsets. The wing walls to be carried 20 feet into the banks of the Nulla. Aprons to be constructed on both sides, 5 feet broad, between arches.

AQUEDUCT OF ONE ARCH 10 FEET SPAN.

MEASUREMENTS.

Excavating Foundation.	Number.	Length.	Breadth.	Depth.	Solid feet.
				mean.	
Abutments	2	26	4·5	3	702
Wingwalls 1st portion	4	9·5	4·5	5	855
		area.			
„ 2nd „	4	27·23		4·75	517·37
		area.			
„ 3rd „	4	19·77		3·5	276·78
				mean.	
Apron on both sides	2	19	5	1·75	332·5
Solid feet excavating foundation .					2,683·65

Filling in Foundation with uncoursed Rubble Stone and Lime Masonry.	Number.	Length.	Breadth.	Depth	Solid feet.
Abutments	2	mean. 25·5	4	3	612
Wingwalls 1st portion	4	mean. 9·62	4·5	3	519·48
„ 2nd „	4	area. 27·23		2	217·84
„ 3rd „	4	area. 19·77		2	158·16
Solid feet filling in foundation with uncoursed stone and lime..					1,507·48

Superstructure. Coursed Rubble Stone and Lime Masonry.	Number.	Length.	Breadth.	Height.	Solid feet.	Solid feet.
Abutments	2	24·5	3	3	441	
Wingwalls 1st portion	4	10	mean. 3·87	6·5	1,006·20	
„ 2nd „	4	area. 22·66		4·5	407·88	
„ 3rd „	4	area. 14·53		2	116·24	
Spandrils with backing	1	23·5	16	3	1,128	
Additional work on abutments	4	2	·5	3	12	
Blocking Course	2	16	3·25	·5	52	
Additional work on abutment	4	2	·5	3	12	
Parapet wall centre portion	2	12	2·5	4	240	
Portion of wall at both ends	4	mean. 11·10	mean. 2·87	5	683·06	
„ next to „	4	area. 36·22		mean. 3·5	507·08	4,605·46
Deduct Archway with arching	1	23·5	area. 25·52		599·72	599·72
Solid feet coursed rubble stone and lime masonry..						4,005·74

Concrete work.	Number.	Length.	Breadth.	Depth.	Solid feet.
Over arch and abutments	1	16	17	·5	136
Solid feet concrete work...					136

Slabstone Arching.	Number.	Length.	Breadth.	Depth.	Solid feet.
Archring excepting face voussoirs	1	21	area. 11·79		247·59
Solid feet slabstone arching...					247·59

Cutstone work dressed, 3rd sort.	Number.	Length.	Breadth.	Depth.	Solid feet.
Voussoirs of arching	2	11·79	1·25	1	29·47
String Course at the foot of parapet wall	2	65·84	·5	·5	32·92
Coping over centre portion of parapet	2	12	area. 1·57		37·68
,, on both sides of ,,	4	12·40	area. 1·99		98·70
,, on wing walls	4	17	area. 1·77		120·36
Solid feet cutstone work dressed, 3rd sort...					319·13

Choonam Plaster.	Number.	Length.	Breadth.	Superficial feet.
Bottom of aqueduct	1	16	17·5	280
Side of do. centre portion	2	12	4·25	102
Do. end	4	mean. 11·90	5·25	249·90
Supl. feet choonam plaster..				631·90

Large rough stone Paving including Masonry Bedding.	Number.	Length.	Breadth.	Superficial feet.
Apron on both sides	2	19	5	190
Supl. feet large rough stone paving..				190

Earthwork.	Number.	Length.	Breadth.	Depth	Solid Feet.
Square portion between wingwalls..	2	16·75	10	4·5	1,507·5
Portion between wingwalls	2	11·75	27·25	2	1,280·75
Embankment over do. for the sides of canals.....	4	11·75	10·37 mean.	5	2,436·95
				Solid feet earthwork..	5,225·20

ABSTRACT.

		Rs. a. p.
2,684	Solid feet excavating foundation, at Rs. 0-12-0 per 100 solid feet..	20 2 0
1,507	Solid feet filling in foundation with uncoursed rubble stone and lime, at Rs. 16-0-0 per 100 solid feet	241 1 11
4,006	Solid feet coursed rubble stone and lime masonry, at Rs. 20-0-0 per 100 solid feet	801 3 2
136	Solid feet concrete work, at Rs. 10-0-0 per 100 solid foot.	13 9 7
29	Solid feet arching of slabstone and lime, at Rs. 25-0-0 per 100 solid feet	7 4 0
319	Solid feet cutstone work dressed, 3rd sort, at Rs. 45-0-0 per 100 solid feet..	143 8 9
632	Supl. feet choonam plaster at Rs. 6-0-0 per 100 supl. feet	37 14 8
120	Supl. feet large roughstone paving, at Rs. 25-0-0 per 100 supl. feet	47 8 0
5,225	Solid feet earthwork, at Rs. 0-12-0 per 100 solid feet.. ..	39 3 0
1	Jungle wood centering, at Rs. 15-0-0 each..	15 0 0
		1,366 7 1
	Contingencies at 5 per cent...	68 5 1
	Extra Establishment.	
1	Carcoon for two months at Rs. 10 per month 20 0 0	
1	Muccadum „ at Rs. 8 „ 16 0 0	36 0 0
	Total Rs..	1,471 0 0
	Add for one more..	1,471 0 0
	Total Rs..	2,942 0 0

AQUEDUCT No. 1.

General Description.

The aqueduct to consist of 6 segmental arches of 10 feet span, 2 feet rise, and one foot thick. The backing to arches over abutments and piers to be carried up to the blocking course, with a

layer of 6" of concrete to render the masonry water-tight. The piers to be 2 feet thick. Foundations of piers and abutments to be carried down 3 feet, in steps of one foot thick each, with 3 inch offsets. Spandril walls to be 3 feet thick. The wingwalls to be carried 20 feet into the banks of the nulla. Foundation in black soil. Aprons to be constructed on both sides 6 feet broad.

AQUEDUCT OF 6 ARCHES, EACH 10 FEET SPAN.

Measurements.	Number.	Length.	Breadth.	Depth.	Solid Feet.
Excavating Foundation.					
Abutment	2	24·75	5	mean 4	990
Wingwalls, 1st portion	4	4·5	4·5	mean 6·5	526·5
Do. 2nd do.	4	5	4·5	mean 4	360
Do. 3rd do.	4	area 27·23		4	435·68
Do. 4th do.	4	area 19·77		3·5	276·78
Piers	5	25·75	3·5	3	1,351·87
Apron on both sides	2	80	6	mean 1·5	1,680
Solid feet excavating foundation...					5,620·82

Filling in Foundation with Uncoursed Rubble Stone and Lime.	Number.	Length.	Breadth.	Depth.	Solid Feet.
Abutments	2	mean 24·25	4·5	3	654·75
Wingwalls, 1st portion	4	mean 4·62	4·5	4	332·64
Do. 2nd do.	4	5	4·5	2	180
Do. 3rd do.	4	area 27·22		2	217·84
Do. 4th do.	4	19·77		1	79·08
Piers	5	mean 25·25	mean 9	3	1,136·25
Solid feet filling in foundation with uncoursed stone and lime...					2,600·56

SUPERSTRUCTURE.	Number	Length.	Breadth.	Height.	SOLID FEET.	SOLID FEET.
Coursed Rubble Stone and Lime.						
Abutments	2	23·25	mean. 3·25	6	906·75	
Piers	5	22·25	2	6	1,335	
Starlings	10	2	mean. ·5	6	60	
Wingwalls, 1st portion	4	mean 5·25	mean 3·87	8·5	690·79	
„ 2nd „	4	5	3·87	6·5	503·10	
„ 3rd „	4	area. 22·66		4·5	407·88	
„ 4th „	4	area. 14·53		3	174·36	
Spandrils with backing	1	76	22·25	3	5,073	
Additional work on abutment	4	2	·5	3	12	
Parapet wall, centre portion	2	72	mean. 2·5	4	1,440	
Portion of do. on both sides	4	mean. 12·40	2·87	5	711·76	
„ next to „	4	area. 36·22		mean. 3·5	507·08	
Additional work on abutment	4	2	·5	.5	2	
Blocking courses	2	76	3·25	·5	247	12,070·72
Deduct archway with arching	6	22·25	area. 25·52		3,406·92	3,406·92
Solid feet coursed rubble stone and lime masonry						8,663·80

Concrete work.	Number.	Length.	Breadth	Depth.	SOLID FEET.
Over Arches, piers and abutments	1	76	15·75	·5	598·5
Solid feet concrete work					598·5

Slabstone Arching.	Number.	Length.	Breadth.	Depth.	SOLID FEET.
Arching excepting face voussoirs	6	19·75	area. 11·79		1397·11
Solid feet arching					1397·11

	Number.	Length.	Breadth.	Depth.	Solid Feet.
Cutstone work, 3rd sort.					
		mean	mean		
Voussoirs of archings	12	11·79	1·25	1	176·85
String course at the foot of parapet wall	2	126·84	·5	·5	63·42
Impost cornice of abutment and piers	1	320·30	·5	·5	80·07
			area		
Coping over centre portion of parapet	2	72	1·57		226·08
			area		
„ on both sides of „	4	12·90	1·99		102·68
		mean	area		
„ „ wing walls	4	17·04	1·77		120·64
Solid feet cutstone work dressed, 3rd sort					769·74

	Number.	Length.	Breadth.	Supl. Feet.
Chunam Plaster.				
Bottom of aqueduct	1	76	16·25	1,235
Parapet wall, inside centre portion	2	72	4·25	612
		mean		
„ end	4	12·40	5·25	260·40
Supl. feet chunam plaster				2,107·40

	Number.	Length.	Breadth.	Supl. Feet.
Large rough stone Paving including Masonry Bedding.				
Apron on both sides	2	80	6	960
Supl. feet large rough stone paving				960

	Number.	Length.	Breadth.	Depth.	Solid Feet.
Earthwork.					
Square portion between wingwalls	2	mean 16	mean 10·25	5·5	1,804
Portion between wingwalls	2	11·75	mean 26	mean 2	1,222
Embankments over do. for the sides of canal.	4	11·75	mean 10·37	5	2,436·95
				Solid feet earthwork..	5,462·95

	Number.	Length.	Breadth.	Height.	Number.
Starling Caps of cutstone, 3rd sort.					
Starling caps	10	2	1	.1	20
				No. of starling caps..	20

Abstract.

5621	Solid feet excavating foundation in black soil, at Rs. 0-12-0 per 100 feet	42	2	6
2601	Solid feet filling in do. with uncoursed rubble stone and lime, at Rs. 16-0-0 per 100 feet..	416	2	6
8664	Solid feet coursed rubble stone and lime masonry, at Rupees 20-0-0 per 100 feet..	1,732	12	9
598	Solid feet concrete work, at Rs. 10-0-0 per 100 feet..	59	12	9
1397	Solid feet arching of slabstone and lime, at Rs. 25-0-0 per 100 ft.	349	4	0
770	Solid feet cutstone work dressed, 3rd sort, at Rs. 45-0-0 per 100 ft	346	8	0
2107	Superficial feet chunam plaster at Rs. 6-0-0 per 10 feet	126	6	8
960	Superficial feet large rough stone paving, at Rs. 25-0-0 per 100 ft	240	0	0
5463	Solid feet earthwork, at Rs. 0-12-0 per 100 feet	40	15	6
20	Nos. of starling caps, at Rs. 4-0-0 each..	80	0	0
3	Nos. of jungle wood centering at Rs. 15-0-0 each	45	0	0
		3,479	0	8
	Contingencies at 5 per cent	173	15	2
	Extra Establishment.			
1	Carcoon for 3 months, at Rs. 10 per month 30 0 0			
1	Muccadum do. at Rs. 8 do. 24 0 0	54	0	0
	Total Rs...	3,707	0	0

AQUEDUCT No. 4.

General Description.

The aqueduct to consist of one segmental arch of 10 feet span, 16¼ feet breadth at bottom, 2 feet rise, and one foot thick. Backing to arches over abutments and piers to be carried up to the blocking course, with a layer of 6″ of concrete on top to render the masonry watertight. Foundation of abutment to be carried down 3 feet in steps of 1 foot thick each, with 3″ offsets. Spandril walls to be 3 feet thick. Wing walls to be carried 20 feet into the banks of the nulla. Embankment to be raised in one foot layer, watered and rammed. Aprons to be constructed on both sides of aqueduct, 5 feet broad between arches.

AQUEDUCT OF ONE ARCH, 10 FEET SPAN, BETWEEN THE 2ND AND 4TH MILES.

Measurements.

Excavating Foundation.	Number.	Length.	Breadth.	Depth.	Solid Feet.
				mean.	
Abutment	2	24·75	4·5	3	668·25
Wing walls, 1st portion	4	9·5	4·5	5	855
		area.			
„ 2nd „	4	27·23		4·75	517·37
		area.			
„ 3rd „	4	19·77		3·5	276·78
		mean			
Apron on both sides	2	19	5	1·75	332·5
Solid feet excavating foundation..					2,649·90

Filling in Foundation with uncoursed Rubble Stone and Lime Masonry.	Number.	Length.	Breadth.	Depth.	Solid Feet.
		mean.			
Abutment	2	24·25	4	3	582
		mean.			
Wing walls, 1st portion	4	9·62	4·5	3	599·48
		area.			
„ 2nd „	4	27·23		2	217·84
		area.			
„ 3rd „	4	19·77		2	158·16
Solid feet filling in foundation with uncoursed rubble stone and lime..					1,477·48

Superstructure.	Number.	Length.	Breadth.	Height.	Solid Feet.	Solid Feet.
Coarsed Rubble Stone and Lime Masonry.						
Abutments	2	23·25	3	3	418	
Wing walls, 1st portion	4	10	mean. 3·87	6·5	1,006·20	
„ 2nd „	4		area. 22·66	4·5	407·88	
„ 3rd „	4		area. 14·53	2	116·24	
Spandrils with backing	1	22·25	16	3	1,068	
Additional work on abutments	4	2	·5	3	12	
Blocking courses	2	16	3·25	·5	52	
Additional work on abutments	4	2	·5	3	12	
Parapet wall, centre portion	2	12	2·5	4	240	
Portion of do. at both ends	4	mean. 11·90	mean. 2·87	5	683·06	
„ next „	4		area. 36·22	area. 3·5	507·08	4,522·96
Deduct Archway with arching	1	22·25	area. 25·52		567·82	567·82
Solid feet coursed rubble stone and lime masonry						3,955·14

Concrete work.	Number.	Length.	Breadth.	Depth.	Solid Feet.
Over arch and abutment	1	16	15·75	·5	126
Solid feet concrete work					126

Slabstone Arching.	Number.	Length.	Breadth.	Depth.	Solid Feet.
Arching excepting face voussoirs	1	19·75	area. 11·79		232·85
Solid feet slabstone arching					232·85

Cutstone work.	Number.	Length	Breadth.	Depth.	Solid Feet.
		area.			
Voussoirs of arching	2	11·79	1·25	1	29·47
String course at the foot of parapet wall	2	65 84	·5	5	32·92
			area		
Coping over centre portion of „	2	12	1·57		37 68
			area		
„ on both sides of „	4	12·40	1·99		98·70
			area		
„ wing walls	4	17	1·77		120·36
Solid feet cutstone work, 3rd sort					319·13

Chunam Plaster.	Number.	Length.	Breadth.	Superficial Feet.
Bottom of aqueduct	1	16	16·25	260
Sides of „ centre portion	2	12	4·25	102
Do. „ ends	4	11·90	5·25	249·90
Supl. feet chunam plaster				611·90

Large Stone Paving.	Number.	Length.	Breadth.	Superficial Feet.
Apron on both sides	2	19	5	190
Supl. feet large rough stone paving				190

Earthwork.	Number.	Length.	Breadth.	Depth.	Solid Feet.
		mean.		mean.	
Square portion between wing walls	2	15·5	10	4·5	13·95
			mean.		
Portion between wing walls	2	11·75	26	2	12·22
			mean.		
Embankment over do. for the sides of canal	4	11·75	10·37	5	2,426·39
Solid feet earthwork					5,053·39

ABSTRACT.

2,650	Solid feet excavating foundation, at Rs. 0-12-0 per 100 solid feet..	19	14	0
1,477	Solid feet filling in foundation with uncoursed rubble stone and lime masonry, at Rs. 16-0-0 per 100 solid feet..	236	5	1
3,955	Solid feet coursed rubble stone and lime masonry, at Rs. 20-0-0 per 100 solid feet..	791	0	0
126	Solid feet concrete work, at Rs. 10-0-0 per 100 solid feet.. ..	12	9	7
232	Solid feet arching of slabstone and lime, at Rs. 25-0-0 per 100 solid feet...	58	4	0
319	Solid feet cutstone work dressed, 3rd sort, at Rs. 45-0-0 per 100 solid feet..	143	8	9
612	Superficial feet chunam plaster, at Rs. 6-0-0 per 100 superficial feet.....	36	11	6
190	Superficial feet large rough stone paving, at Rs. 25-0-0 per 100 superficial feet...	47	8	0
5,053	Solid feet earthwork, at Rs. 0-12-0 per 100 solid feet..	37	14	4
1	Jungle wood centering, at Rs. 15-0-0 each..	15	0	0
		1,398	11	3
	Contingencies at 5 per cent...	69	14	4
	EXTRA ESTABLISHMENT.			
1	Carcoon for 2 months, at Rs. 10 per month.. .. .. .. 20 0 0			
1	Muccadum do. at Rs. 8 do. 16 0 0	36	0	0
	Total Rs..	1,485	0	0
	Add for two more..	2,970	0	0
	Total for three...	4,455	0	0

AQUEDUCT No. 4.

General Description.

The aqueduct to consist of one segmental arch of 10 feet span, 15 feet breadth at bottom, 2 feet rise, and one foot thick. Backing to arches over abutments and piers to be carried up to the blocking course, with a layer of 6″ of concrete on top to render the masonry watertight. Foundations of abutments to be carried down three feet in steps of one foot thick each, with 3″ offsets. Spandril walls to be 3 feet thick. Wing walls to be carried 20 feet into the banks of the nulla. Embankment to be raised in one foot layer, watered and rammed. Aprons to be constructed on both sides of aqueduct, 5 feet broad, between arches.

AQUEDUCT OF ONE ARCH 10 FEET SPAN BETWEEN 6TH AND 9TH MILES.

MEASUREMENTS.

	Number.	Length.	Breadth.	Depth.	SOLID FEET.
Excavating Foundation.					
Abutments	2	23·5	4·5	mean 3	634·5
Wing walls, 1st portion	4	9·5	4·5	5	855
„ 2nd „	4	area 27·23		4·75	517·37
„ 3rd „	4	area 19·77		3·5	276·78
Apron on both sides	2	19	5	mean 1·75	232·5
Solid feet excavating foundation..					2,616·15

	Number.	Length.	Breadth.	Depth.	SOLID FEET.
Filling in Foundation.					
Abutments	2	mean 23	4	3	552
Wing walls, 1st portion	4	mean 9·62	4·5	3	519·48
„ 2nd „	4	area 27·23		2	217·84
„ 3rd „	4	area 19·77		2	158·16
Solid feet filling in foundation..					1,447·48

Superstructure.	Number.	Length.	Breadth	Height.	Solid Feet.	Solid Feet.
Coursed Rubble Stone and Lime Masonry.						
Abutment	2	22	3	3	396	
Wings walls, 1st portion	4	10	mean 3·87	6·5	1,006·20	
„ 2nd „	4		area 22·66	4·5	407·88	
„ 3rd „	4		area 14·53	2	116·24	
Spandrils with backing	1	21	16	3	1,008	
Additional work on abutments ..	4	2	·5	3	12	
Blocking course	2	16	3·25	·5	52	
Additional work on abutments ...	4	2	·5	3	12	
Parapet walls, centre portion ..	2	12	2·5	3·5	210	
Portions of „ at both ends....	4	mean 11·90	mean 2·87	5	683·05	
„ next „ ..	4		area 36·22	area 3·5	507·08	4,410·45
Deduct archway with arching ..	1	21	area 25·52		535·92	535·92
Solid feet coursed rubble stone and lime masonry...						3874·53

	Number.	Length.	Breadth.	Depth.	Solid feet.
Concrete Work.					
Over arch and abutments	1	16	14·5	·5	116
Solid feet concrete work..					116

	Number.	Length.	Breadth.	Depth.	Solid Feet.
Slabstone Arching.					
Archring excepting face voussoirs	1	1·85	area 11·79		218·11
Solid feet slabstone arching..					218·11

	Number.	Length.	Breadth.	Depth.	Solid Feet.
Cutstone work, 3rd sort.					
Voussoirs of arching	2	area 11·79	1·25	1	29·47
String course at the foot of parapet walls	2	65·84	·5	·5	32·92
Coping over centre portion of „	2	12	area 1·57		37·68
„ on both sides of „	4	12·40	area 1·99		98·70
„ wing walls	4	17	area 1·77		120·36
Solid feet cutstone work dressed, 3rd sort...					319·13

	Number.	Length.	Breadth.	Supl. Feet.
Chunam Plaster.				
Bottom of aqueduct	1	16	15	240
Sides of „ centre portion	2	12	3·75	90
„ ends	4	mean 11·90	5·25	249·90
Supl. feet Chunam plaster..				579·90

	Number.	Length.	Breadth.	Supl. Feet.
Large rough Stone Paving.				
Apron on both sides	2	19	5	190
Supl. feet large rough stone paving...				190

Earthwork.	Number.	Length.	Breadth.	Depth.	Solid Feet.
Square portion between wing walls	2	14·25	10	4·5	1,282·5
Portion between wing walls	2	11·75	mean 24·75	2	1,163·25
Embankments over do. for the sides of canals.	4	11·75	mean 10·37	5	2,436·95
			Solid feet earthwork..		4,882·70

Abstract.

2616	Solid feet excavating foundation, at Rs. 0-12-0 per 100 solid feet	19	9	11
1447	Solid feet filling in do. with uncoursed rubble stone and lime, at Rs. 16-0-0 per 100 solid feet	231	8	3
3875	Solid feet coursed rubble stone and lime masonry, at Rupees 20-0-0 per 100 solid feet..	775	0	0
116	Solid feet concrete work, at Rs. 10-0-0 per 100 solid feet.. ..	11	9	7
218	Solid feet arching of slabstone and lime, at Rs. 25-0-0 per 100 solid feet..	54	8	0
319	Solid feet cutstone work dressed, 3rd sort, at Rs. 45-0-0 per 100 solid feet	143	8	9
580	Superficial feet chunam plaster, at Rs. 6-0-0 per 100 supl. feet..	34	12	9
190	Superficial feet large rough stone paving, at Rs. 25-0-0 per 100 supl. feet	47	8	0
4883	Solid feet earthwork, at Rs. 0-12-0 per 100 solid feet.	36	9	11
1	Jungle wood centreing, at Rs. 15-0-0 per each	15	0	0
		1369	11	2
	Add contingencies at 5 per cent	68	7	9
	Extra Establishment.			
1	Carcoon for 2 months, at Rs. 10 per month 20 0 0			
1	Muccadum do. at Rs. 8 do. 16 0 0	36	0	0
	Total Rs...	1,474	0	0
	Add for three more..	4,422	0	0
	Total for four..	5,896	0	0

AQUEDUCT No. 3.

General Description.

The aqueduct to consist of 2 segmental arches of 10 feet span and 2 feet rise, and 1 foot thick. The backing to arches over abutments and piers to be carried up to the blocking course, with a layer of 6″ of concrete to render the masonry watertight. The

piers to be 2 feet thick ; foundations of piers and abutments to be carried down three feet, in steps of one foot thick each, with three-inch offsets. Spandril walls to be 3 feet thick. The wing walls to be carried 15½ feet into the banks of the nulla. The foundations of this bridge is in moorum. Aprons to be constructed on both sides, 5.5 feet broad between arches.

AQUEDUCT OF TWO ARCHES 10 FEET SPAN.

Measurements.

Excavating Foundation.	Number.	Length.	Breadth.	Depth.	Solid Feet.
Abutments	2	23·5	4·5	mean 3	634·5
Wing walls, 1st portion	4	5	4·5	mean 4·5	405
Ditto 2nd ditto	4	area. 27·23		4·5	490·14
Ditto 3rd ditto	4	area. 19·77		4	316·32
Piers	1	22·5	3·5	3	236·25
Apron on both sides	2	31	5·5	mean 1·75	596·75
Solid feet excavating foundation					2,678·96

Filling in Foundation with uncoursed Rubble Stone and Lime Masonry.	Number.	Length.	Breadth.	Depth.	Solid feet.
Abutments	2	mean. 23	4	3	552
Wing walls, 1st portion	4	mean. 5·12	4·5	2	184·32
Ditto 2nd ditto	4	area. 27·23		3·5	381·22
Ditto 3rd ditto	4	area 19·77		2	158·16
Pier	1	22	3	3	198
Solid feet filling in foundation with uncoursed stone and lime					1,473·70

SUPERSTRUCTURE.	Number.	Length.	Breadth.	Height.	SOLID FEET.	SOLID FEET.
Coursed Rubble Stone and Lime Masonry.						
Abutments	2	22	2·75	4	484	
Piers	1	21	2	4	168	
		mean.	mean.			
Wing walls, 1st portion	4	5·96	3·87	8·5	784·21	
		area.				
Ditto 2nd ditto	4	22·66		5	453·20	
		area.				
Ditto 3rd ditto	4	14·53		3	174·36	
Spandrils with backing	1	26·56	21	3	1,673·28	
Additional work on abutments	4	1·07	·5	3	6·42	
		mean.				
Blocking course	2	26·18	3·25	·5	85·08	
Additional work on abutments	4	1·07	·5	·5	1·07	
			mean.			
Parapet wall, centre portion	2	24	2·5	3·5	420	
		mean.	mean.			
Portion of centre at both ends	4	7·40	2·87	5	424·76	
		area.				
„ next to „	4	36·22		3·5	507·08	5,181·46
			area.			
Deduct archway with arching	2	21	25·52		1,071·84	1,071·84
Solid feet coursed rubble stone and lime masonry						4,109·62

Concrete Work.	Number.	Length.	Breadth.	Depth.	SOLID FEET.
Over arches, piers and abutments	1	26·18	14·5	·5	189·80
Solid feet concrete work					189·80

Slab Stone Arching.	Number.	Length.	Breadth.	Depth.	SOLID FEET.
			area.		
Arching excepting face voussoirs	2	18·5	11·79		436·23
Solid feet slabstone arching					436.23

Cutstone Work, 3rd Sort	Number.	Length.	Breadth.	Depth.	Solid Feet.
		mean	mean		
Voussoirs of arching	4	11·79	1·25	1	58·95
String course at the foot of parapet wall	2	68·84	·5	·5	34·42
			area		
Coping over centre portion of parapet	2	24	1·57		75·36
		mean	area		
Ditto on both sides of parapet	4	7·90	1·99		62·88
			area		
Ditto on wing walls	4	17	1·77		122·36
Solid feet cutstone work dressed, 3rd sort					353·77

Chunam Plaster.	Number.	Length.	Breadth.	Supl. Feet.
Bottom of aqueduct	1	26·12	15	391·80
Sides of centre portion	2	24	4·25	204
		mean		
Ditto end „	4	7·40	5·25	155·40
Superficial feet chunam plaster				751·20

Large rough Stone Paving including Masonry Bedding.	Number.	Length.	Breadth.	Supl. Feet.
Apron on both sides	2	31	5·5	341
Superficial feet large rough stone paving				341

Earthwork.	Number.	Length.	Breadth.	Depth.	Solid Feet.
		mean		mean	
Square portion between wingwalls.....	2	14·25	5·96	6·5	1104·09
			mean	mean	
Portion between wingwalls.....	2	11·75	24·75	2·75	1599·46
			mean		
Embankment over do. for the sides of Canals,	4	11·75	10·37	5	2436·96
Solid feet earthwork..... ...					5140·5

ABSTRACT.

2679	Solid feet excavating foundation, at Rs. 1-0-0 per 100 solid feet..	26	12	7
1474	Solid feet filling in do. with uncoursed rubble stone and lime, at Rs. 16-0-0 per 100 solid feet	235	13	5
4110	Solid feet coursed rubble stone and lime masonry, at Rs. 20-0-0 per 100 solid feet	822	0	0
190	Solid feet concrete work, at Rs. 10-0-0 per 100 solid feet.. ...	19	0	0
436	Solid feet arching of slabstone and lime, at Rs. 25-0-0 per 100 solid feet	109	0	0
354	Solid feet cutstone work dressed, 3rd sort, at Rs. 45-0-0 per 100 solid feet	159	4	9
751	Superficial feet chunam plaster at Rs. 6-0-0 per 100 supl. feet..	45	0	11
341	Superficial feet large rough stone paving, at Rs. 25-0-0 per 100 superficial feet	85	4	0
5140	Solid feet earthwork, at Rs. 0-12-0 per 100 solid feet	38	8	9
2	No of jungle-wood centreings, at Rs. 15-0-0 per each	30	0	0
		1570	12	5
	Contingencies at 5 per cent...	78	8	7
	EXTRA ESTABLISHMENT.			
1	Carooon for 3 months, at Rs. 10 per month... .. .. .. 30 0 0			
1	Muccadum ditto at Rs. 8 per month... .. .. .. 24 0 0	54	0	0
	Total Rs.....	1703	0	0

AQUEDUCT No. 4.

General Description.

The aqueduct to consist of one segmental arch of 10 feet span, 13¾ feet breadth at bottom, 2 feet rise, and one foot thick. Backing to arches over abutments and piers to be carried up to the blocking course, with a layer of 6″ of concrete on top to render the

masonry water-tight. Foundation of abutments to be carried down three feet, in steps of one foot thick each, with 3 inch offsets. Spandril walls to be 3 feet thick. Wingwalls to be carried 20 feet into the banks of the nulla. Embankments to be raised in one foot layer watered and rammed. Aprons to be constructed on both sides of aqueduct, 5 feet broad between arches.

AQUEDUCT OF ONE ARCH 10 FEET SPAN BETWEEN 9TH AND 13TH MILES.

MEASUREMENTS.	Number.	Length.	Breadth.	Depth.	SOLID FEET.
Excavating Foundation.					
Abutment	2	22·25	4·5	mean 3	600·75
Wingwalls, 1st portion	4	9·5	4·5	5·	855
Do. 2nd do.	4	area 27·23		4·75	517·37
Do. 3rd do.	4	area 19·77		3·5	276·78
Apron on both sides	2	19	5	mean 1·75	332·5
				Solid feet excavating foundation...	2,582·40

Filling in Foundation.	Number.	Length.	Breadth.	Depth.	SOLID FEET.
Abutments	2	mean. 21·75	4	3	522
Wingwalls, 1st portion	4	mean. 9·62	4·5	3	519·48
„ 2nd „	4	area. 27·23		2	217·84
„ 3rd „	4	area. 19·77		2	158·16
				Solid feet filling in foundation..	1,417·48

Superstructure. Coursed Rubble Stone and Lime.	Number.	Length.	Breadth.	Height.	Solid Feet.	Solid Feet.
Abutment	2	20·75	3	3	373·5	
Wing walls, 1st portion	4	10	mean. 3·87	6·5	1,006·20	
„ 2nd „	4	area. 22.66		4·5	407·88	
„ 3rd „	4	area. 14·53		2	116·24	
Spandrils with backing	1	19·75	16	3	948	
Additional work on abutment	4	2	·5	3	12	
Blocking courses	2	16	3·25	·5	52	
Additional work on abutment	4	2	·5	3	12	
Parapet walls centre portion	2	12	2·5	3.5	210	
Portion of walls at both ends	4	11·90	2·87	5	683·06	
„ next to „	4	area. 36·22		3·5	507·58	4,823·64
Deduct arching with archring	1	19·75	area. 25·52		504·02	504·02
Solid feet coursed rubble stone and lime						3,824·62

Concrete work.	Number.	Length.	Breadth.	Depth.	Solid. Feet.
Over arch and abutment	1	16	13·25	·5	106
Solid feet concrete work					106

Slabstone Arching.	Number.	Length.	Breadth.	Depth.	Solid Feet.
Arching excepting face voussoirs	1	17·25	area. 11·79		203·37
Solid feet slabstone arching					203·37

Cutstone Work.	Number.	Length	Breadth.	Depth.	Solid Feet.
		area			
Voussoirs of arching	2	11·79	1·25	1	29·47
String course at the foot of parapet walls	2	65·84	·5	·5	32·92
			area.		
Coping over centre portion of „	2	12	1·57		37·68
			area.		
„ on both sides of „	4	12·40	1·99		98·70
			mean area.		
„ on wing walls	4	17	1·77		120·36
Solid feet cutstone work dressed, 3rd sort					319·13

Chunam Plaster.	Number.	Length.	Breadth.	Superficial Feet.
Bottom of aqueduct	1	16	13·75	220
Sides of do., centre portion	2	12	3·75	90
		mean.		
Do. ends	4	11·90	5·25	249·90
Supl. feet chunam plaster				559·90

Large rough Stone Paving.	Number.	Length.	Breadth.	Superficial Feet.
Apron on both sides	2	19	5	190
Supl. feet large rough stone paving				190

Earthwork.	Number.	Length.	Breadth.	Depth	Solid Feet.
Square portion between wing walls..	2	13	10	4·5	1,170
Portion between wing walls.....	2	11·75	mean. 23·5	2	1,104·5
Embankment over do. for the sides of canals.....	4	11·75	10·37	5	2,436·95
				Solid feet earthwork..	4,711·45

ABSTRACT.

		Rs.	a.	p.
2,582	Solid feet excavating foundation, at Rs. 0-12-0 per 100 solid feet..	19	5	10
1,417	Solid feet filling in foundation, with uncoursed rubble stone and lime, at Rs. 16-0-0 per 100 solid feet	226	11	6
3,825	Solid feet coursed rubble stone and lime masonry, at Rs. 20-0-0 per 100 solid feet	76	8	0
106	Solid feet concrete work, at Rs. 10-0-0 per 100 solid feet.	10	9	7
203	Solid feet arching of slabstone and lime, at Rs. 25-0-0 per 100 solid feet	50	12	0
319	Solid feet cutstone work dressed, 3rd sort, at Rs. 45-0-0 per 100 solid feet..	143	8	9
560	Supl. feet chunam plaster, at Rs. 6-0-0 per 100 solid feet	33	9	7
190	Supl. feet large roughstone paving, at Rs. 25-0-0 per 100 solid. feet	47	8	0
4,711	Solid feet earthwork, at Rs. 0-12-0 per 100 solid feet.. ..	35	5	3
1	Jungle wood centreing, at Rs. 15-0-0 each..	15	0	0
		658	14	6
	Contingencies at 5 per cent.	32	15	1
	Extra Establishment.			
1	Carcoon for two months at Rs. 10 per month 20 0 0			
1	Muccadum „ at Rs. 8 „ 16 0 0	36	0	0
	Total Rs..	728	0	0
	Add for one more..	728	0	0
	Total for two..	1,456	0	0

AQUEDUCT No. 2.

General Description.

The aqueduct to consist of four segmental arches of 10 feet span, each 2 feet rise, and one foot thick. The abutments to be $2\frac{3}{4}$ feet thick; backing to arches over abutments and piers to be carried up

to the blocking course, with 6″ of concrete on top to render the masonry watertight. Piers to be 2 feet thick. Foundations of piers and abutments to be carried down 3 feet in steps of one foot thick, each with 3″ offsets. The spandrill wall to be three feet thick. The wing walls to be carried 20 feet into the banks of the nulla; foundation to be in moorum. Aprons to be constructed on both sides, 5 feet broad, between arches.

AQUEDUCT OF FOUR ARCHES EACH 10 FEET SPAN.

MEASUREMENTS.

Excavating Foundation.	Number.	Length.	Breadth.	Depth.	SOLID FEET.
				mean.	
Abutments	2	22·25	4·5	3	600·75
Wing walls, 1st portion	4	9·5	4·5	4	684
			area.		
„ 2nd „	4	27·23		4	435·68
			area.		
„ 3rd „	4	19·77		4·25	336·09
Pier	3	23·25	3·5	3	732·37
				mean.	
Apron on both sides	2	55	5	1·75	962·5
Solid feet excavating foundation .					3,751·39

Filling in Foundation with uncoursed Rubble Stone and Lime Masonry.	Number.	Length.	Breadth.	Depth.	SOLID FEET.
Abutment	2	21·75	4	3	522
		mean.			
Wing walls, 1st portion	4	9·62	4·5	2	346·32
			area.		
„ 2nd „	4	27·23		2	217·84
			area.		
„ 3rd „	4	19·77		2	158·16
		mean.			
Piers.	3	22·75	3	3	614·25
Solid feet filling in foundation..					1,858·57

Superstructure. Coursed Stone and Lime.	Number.	Length.	Breadth.	Height.	Solid Feet.	Solid Feet.
			mean.			
Abutments	2	20·75	2·75	3	342·37	
Piers	3	19·75	2	3	355·5	
Starlings	6	·2	·5	3	18	
		mean.	mean.			
Wing walls, 1st portion	4	10·54	3·87	7·5	1,223·69	
		area.				
„ 2nd „	4	22·66		5·5	498·52	
		area.				
„ 3rd „	4	14·53		3·5	203·42	
		mean.				
Spandrils with backing	1	50·41	19·75	3	2986·79	
Additional work on abutments	4	0·91	·5	3	5·46	
		mean.				
Blocking courses	2	49·91	3·25	·5	162·20	
Additional work on abutments	4	·91	·5	·5	·91	
			mean.			
Parapet wall, centre portion	2	48	2·5	4	960	
		mean.	mean.			
Portion of do. at both ends	4	11·90	2·87	5	683·06	
		area.				
„ next „	4	36·22		3·5	507·08	7,947
			area.			
Deduct archway with archring	4	19·75	25·52		2,016·08	2,016·08
Solid feet coursed rubble stone and lime masonry						9,530·92

Concrete work.	Number.	Length.	Breadth.	Depth.	Solid Feet.
Over arches, piers and abutments	1	49·91	13·25	·5	330·65
Solid feet concrete work					330·65

Slabstone Arching.	Number.	Length.	Breadth.	Depth.	Solid Feet.
				area.	
Arching excepting face voussoirs	4	17·25	11·79		813·51
Solid feet slabstone arching					813·51

Cutstone work, dressed, 3rd sort.	Number.	Length.	Breadth.	Depth.	Solid Feet.
		area.			
Voussoirs of arching	8	11·79	1·25	1	117·90
String course at the foot of parapet walls	2	101·84	·5	·5	50·92
Impost cornice of abutment and pier	1	193·18	·5	·5	48·29
			area		
Coping over centre portion of parapet	2	48	1·57		150·72
			area		
„ on both sides of „	4	12·40	1·99		98·70
			area		
„ on wing walls	4	17	1·77		120·36
Solid feet cutstone work, dressed, 3rd sort					586·89

Chunam Plaster.	Number.	Length.	Breadth.	Superficial Feet.
Bottom of aqueduct	1	49·83	13·75	685·16
Parapet wall inside, centre portion	2	48	4·25	408
		mean		
Do. end	4	11·90	5·25	249·90
Supl. feet chunam plaster				1343·06

Large rough Stone Paving.	Number.	Length.	Breadth.	Superficial Feet.
Apron on both sides	2	55	5	550
Supl. feet large rough stone paving				550

Earthwork.	Number.	Length.	Breadth.	Depth.	Solid Feet.
		mean.	mean.	mean.	
Square portion between wing walls	2	13	10·54	5·5	1,507·22
		mean.	mean.		
Portion between wing walls	2	11·75	23·5	2·25	1,242·56
			mean.		
Embankment over do. for the sides of canal	4	11·75	10·37	5	2,436·95
Solid feet earthwork					5,186·73

Starling Caps.

	Number.	Length.	Breadth.	Height.	Number.
Starling caps	6	2	1	1	6
Number of Starling Caps...					6

ABSTRACT.

3,751	Solid feet excavating foundation, at Rs. 1-0-0 per 100 solid feet	37	8	1
1,859	Solid feet filling in foundation with uncoursed rubble stone and lime masonry, at Rs. 16-0-0 per 100 solid feet	297	7	0
5,931	Solid feet coursed rubble stone and lime masonry, at Rs. 20-0-0 per 100 solid feet	1,186	3	2
331	Solid feet concrete work, at Rs. 10-0-0 per 100 solid feet	33	1	7
814	Solid feet arching of slabstone and lime, at Rs. 25-0-0 per 100 solid feet	203	8	0
587	Solid feet cutstone work dressed, 3rd sort, at Rs. 45-0-0 per 100 solid feet	264	2	4
1,343	Superficial feet chunam plaster, at Rs. 6-0-0 per 100 superficial feet	80	9	3
550	Superficial feet large rough stone paving, at Rs. 25-0-0 per 100 superficial feet	137	8	0
5,187	Solid feet earthwork, at Rs 0-12-0 per 100 solid feet	38	14	5
6	Number of starling caps, at Rs. 3-0-0 each	18	0	0
2	Number of junglewood centering, at Rs. 15-0-0 each	30	0	0
		2,326	13	10
	Contingencies at 5 per cent...	116	5	5

EXTRA ESTABLISHMENT.

1 Carcoon for 6 months, at Rs. 10 per month	60	0	0	
1 Muccadum do. at Rs. 8 do.	48	0	0	108	0	0
			Total Rs..	2,551	0	0

AQUEDUCT No. 4.

General Description.

The aqueduct to consist of one segmental arch of 10 feet span, 12½ feet breadth at bottom, 2 feet rise, and one foot thick. Backing to arches over abutments and piers to be carried up to the blocking course, with a layer of 6″ of concrete on top to render the masonry watertight. Foundation of abutment to be carried down 3 feet in steps of 1 foot thick each, with 3″ offsets. Spandril walls to be 3 feet thick. Wing walls to be carried 20 feet into the banks of the nulla. Embankments to be raised in one foot layer, watered and rammed. Aprons to be constructed on both sides of aqueduct, 5 feet broad between arches.

AQUEDUCT OF ONE ARCH, 10 FEET SPAN, BETWEEN THE 14TH AND 15TH MILES.

Measurements.

Excavating Foundation.	Number.	Length.	Breadth.	Depth.	Solid Feet.
				mean.	
Abutments	2	21	4·5	3	567
Wing walls, 1st portion	4	9·5	4·5	5	855
		area.			
„ 2nd „	4	27·23		4·75	517·37
		area.			
„ 3rd „	4	19·77		3·5	276·78
				mean	
Apron on both sides	2	19	5	1·75	332·5
Solid feet excavating foundation..					2,548·65

Filling in Foundation	Number.	Length.	Breadth.	Depth.	Solid Feet.
		mean.			
Abutment	2	20·5	4	3	492
Wing walls, 1st portion	4	9·62	4·5	3	519·48
		area.			
Do. 2nd do.	4	27·23		2	217·84
		area.			
Do. 3rd do.	4	19·77		2	158·16
Solid feet filling in foundation...					1,387·48

SUPERSTRUCTURE.	Number.	Length.	Breadth.	Height.	SOLID FEET.	SOLID FEET.
Coursed Rubble Stone and Lime Masonry.						
Abutment	2	19·5	3 mean	3	351	
Wings walls, 1st portion	4	10	3·87 area	6·5	1,006·20	
„ 2nd „	4		22·66 area	4·5	407·88	
„ 3rd „	4		14·53 area	2	116·24	
Spandril with backing	1	18·5	16	3	888	
Additional work on abutment	4	2	·5	3	12	
Blocking course	2	16	3·25	·5	52	
Additional work on abutment	4	2	·5	3	12	
Parapet wall, centre portion	2	12	2·5	3·5	210	
Portion of do. at both ends	4	11·90	2·87 area	5	683·06	
„ next „	4		36·22 area	3·5	507·08	3,855·46
Deduct archway with arching	1	18·5	25·52		480·37	480·37
Solid feet coursed rubble stone and lime masonry...						3375·09

	Number.	Length.	Breadth.	Depth.	SOLID FEET.
Concrete Work.					
Over arch and abutment	1	16	12	·5	96
Solid feet concrete work..					96

	Number.	Length.	Breadth.	Depth.	SOLID FEET.
Slabstone Arching.					
Arching excepting face voussoirs	1	16	area 11·79		188·64
Solid feet slabstone arching..					188·64

	Number.	Length.	Breadth.	Depth.	Solid Feet.
Cutstone work dressed, 3rd sort.					
Voussoirs of arching	2	11·79	1·25	1	29·47
String course at the foot of parapet walls	2	65·84	·5	·5	32·92
Coping over centre portion of „	2	12	area 1·57		37·68
„ on both sides of „	4	12·40	area 1·99		98·70
„ wing walls	4	17	area 1·77		120·36
Solid feet cutstone work dressed, 3rd sort...					319·13

	Number.	Length.	Breadth.	Supl. Feet.
Chunam Plaster.				
Bottom of aqueduct	1	16	12·5	207·20
Sides of do. centre portion	2	12	3·75	90
ends	4	11·90	5·25	249·90
Supl. feet Chunam plaster..				547·10

	Number.	Length.	Breadth.	Supl. Feet.
Large Rough Stone Paving.				
Apron on both sides	2	19	5	190
Supl. feet large rough stone paving...				190

Earthwork.	Number.	Length.	Breadth.	Depth.	Solid Feet.
Square portion between wing walls	2	11·75	10	4·5	1,057·5
Portion between wing walls	2	11·75	22·25	2	1,045·75
Embankment over do. for the sides of canal..	4	11·75	10·37	5	2,436·95
				Solid feet earthwork..	4,540·20

Abstract.

2,549	Solid feet excavating foundation, at Rs. 0-12-0 per 100 solid feet	19	1	10
1387	Solid feet filling in do. with uncoursed rubble stone and lime, at Rs. 16-0-0 per 100 solid feet	221	14	8
3,375	Solid feet coursed rubble stone and lime masonry, at Rupees 20-0-0 per 100 solid feet..	675	0	0
96	Solid feet concrete work, at Rs. 10-0-0 per 100 solid feet.. ..	9	9	7
189	Solid feet arching of slabstone and lime, at Rs. 25-0-0 per 100 solid feet...	47	4	0
319	Solid feet cutstone work dressed, 3rd sort, at Rs. 45-0-0 per 100 solid feet	143	8	9
547	Superficial feet chunam plaster, at Rs. 6-0-0 per 100 solid feet..	32	13	1
190	Superficial feet large rough stone paving, at Rs. 25-0-0 per 100 solid feet	47	8	0
4,540	Solid feet earthwork, at Rs. 0-12-0 per 100 solid feet.	34	0	9
1	Jungle wood centreing, at Rs. 15-0-0 per each	15	0	0
		1245	12	8
	Add contingencies at 5 per cent	62	4	7
	Extra Establishment.			
1	Carcoon for 2 months, at Rs. 10 per month 20 0 0			
1	Muccadum do. at Rs. 8 do. 16 0 0	36	0	0
	Total Rs...	1,344	0	0
	Add for one more..	1,344	0	0
	Total Rupees..	2,688	0	0

ESCAPES OF 2 OPENINGS.

General Description.

The escape to have 2 openings or sluice gates, 2 feet wide and 4 feet deep, each opening being 3 feet apart. The wall of escape to be continued 3 feet beyond sluice, with its crest at the same level as crest of sluice. Beyond that point the wing walls to be carried

with a thickness of one foot, 12 feet into the bank of canal, 3 feet higher than crest of sluice, or 2 feet higher than flood level. The sluice wall to be $2\frac{1}{2}$ feet thick. The foundations of sluice wall to be $3\frac{1}{2}$ feet deep. An apron to be placed on outer side of sluice 4 feet wide and 1 foot deep.

MEASUREMENTS.

Excavation in Moorum.	Number.	Length.	Breadth.	Height.	Solid Contents.
Sluice walls	1	19	3	3·5	199·50
Wing walls	2	12	1·75	7	294·00
Apron	1	19	4	2·5	190·00
Total solid feet excavating in moorum..					683·50

Foundation.	Number.	Length.	Breadth.	Height.	Solid Contents.
Sluice walls	1	19	3	3·5	199·50
Wing walls	2	6	2·12	2	25·44
Wing walls	2	3	1·87	1	11·22
Apron	1	19	4	1	76·00
Total solid feet foundation..					312·26

Superstructure.	Number.	Length.	Breadth.	Height.	Solid Contents.
Sluice walls	1	15	2·5	4	150·00
Sluice walls	2	3	2·12	6·5	32·68
Wing walls	2	3	1·87	6·5	72·93
Wing walls	2	6	1	6·5	78·00
Total solid feet superstructure..					383·61

	Number.	Length.	Breadth.	Height.	Superficial Contents.
Cutstone Work.					
Facings of sides and sills of sluices	2	10	2·5	....	50
Total superficial feet cutstone work...					50

	Number.	Length.	Breadth.	Height.	Solid Contents.
Woodwork.					
Gates to sluices	2	4·5	2·5	2½	4·68
Total solid feet teak woodwork..					4·68

ABSTRACT.

683	Solid feet excavating, at 1 Rupee per 100 solid feet	6	13	3
312	Solid feet uncoursed rubble masonry, at 16 Rupees per 100 solid feet	49	14	8
384	Solid feet coursed rubble masonry, at 20 Rupees per 100 solid feet	76	12	9
50	Superficial feet 3rd sort cutstone work, at 45 Rupees per 100 superficial feet..	22	8	0
5	Solid feet teak wood, at 4 Rupees per cubic foot..	20	0	0
	Total..	176	0	8
	Add Contingencies at 5 per cent	8	12	10
	Extra Establishment.			
1	Karkoon for ½ month, at 10 Rupees per month	5	0	0
1	Muccadum do. at 8 Rupees do.	4	0	0
	Total Rupees for an escape of 2 openings..	194	0	0

(Signed) F. R. GRIFFTH,
Executive Engineer for Irrigation A. N.

ESCAPE OF 2 OPENINGS.

General Description.

The escape to have two openings or sluice gates, 2 feet wide, and 3 feet deep; each opening being 3 feet apart. The wall of

escape to be continued 3 feet beyond sluice with its crest at the same level as crest of sluice. Beyond that point the wing walls to be carried, with a thickness of one foot, 12 feet in the bank of canal, 3 feet higher than crest of sluice, or 2 feet higher than flood level. The sluice wall to be 2 feet thick. The foundations of sluice wall to be $3\frac{1}{2}$ feet deep. An apron to be placed on outer side of sluice 4 feet wide, and 1 foot deep.

Measurements.

Excavation.	Number.	Length.	Breadth.	Height.	Solid Contents.
Sluice walls	1	19·0	2·5	3·5	166·25
Wing walls	2	12·0	1·5	7·0	252·0
Apron	1	19·0	4·0	2·5	190·0
Total solid feet excavation					608·25

Foundation.	Number.	Length.	Breadth.	Height.	Solid Contents.
Sluice walls	1	19·0	2·5	3·5	166·25
Wing walls	2	3·0	1·75	2·0	21·00
Wing walls	2	3·0	1·25	1·0	7·50
Apron	1	19·0	4·0	1·0	76·00
Total solid feet foundation					270·75

Superstructure.	Number.	Length	Breadth.	Height.	Solid Contents.
Sluice walls	1	15·0	2·0	3·0	90·00
Sluice walls	2	3·0	1·75	6·5	68·25
Wing walls	2	3·0	1·25	6·5	48·75
Wing walls	2	6·0	1·0	6·5	78·00
Total solid feet superstructure					285·00

Cutstone Work.	Number.	Length.	Breadth.	Height.	Superficial Contents.
Facings of sides and sills of sluices.....	2	8·0	2·0	..	32·00
Total superficial feet 3rd sort cutstone work..					32·00

Woodwork.	Number.	Length.	Breadth.	Height.	Solid Content.
Gates to sluices.....	2	3·5	2·5	2½	3·64
Total solid feet teak wood work...					3·64

ABSTRACT.

608	Solid feet excavation, at 1 Rupee per 100 solid feet..	6	1	3
271	Solid feet uncoursed rubble masonry, at 16 Rupees per 100 solid feet.....	43	5	9
285	Solid feet coursed rubble masonry, at 20 Rupees per 100 solid feet...	57	0	0
32	Superficial feet 3rd sort cutstone work, at 45 Rupees per 100 superficial feet..	14	6	4
4	Solid feet teak wood, at 4 Rupees per 100 cubic foot..	16	0	0
	Total...	136	13	4
	Add contingencies at 5 per cent...	6	13	5

Establishment.

1	Karkoon for ½ month, at 10 Rupees per month..	5	0	0
1	Muccadum for ½ month at 8 Rupees per month..	4	0	0
	Total Rs.....	153	0	0
	Add for two more..	306	0	0
		459	0	0

F. R. GRIFFITH,
Executive Engineer for Irrigation A. N.

ESCAPE OF 3 OPENINGS.

General Description.

The escape to have three openings or sluice gates, 2 feet wide, and 3 feet deep, each opening to be 3 feet apart. The wall of escape to be continued 3 feet beyond sluices, with its crest at the same level as crest of sluice. Beyond that point the wing wall to be carried out with a thickness of 1 foot, 12 feet into the bank of canal, three feet higher than crest of sluices, or 2 feet above flood level. The sluice wall to be 2 feet thick. The foundation of sluice wall to be 3½ feet deep. An apron, to be placed on outer side of sluice 4 feet wide and 1 foot deep.

Measurements.

Excavation.	Number.	Length.	Breadth.	Height.	Solid Contents.
Sluice wall	1	24·0	2·5	3·5	210·00
Wing wall	2	12·0	1·5	7·0	252·00
Apron	1	24·0	4·0	2·5	240·00
Total solid feet excavation..					702·00

Foundation.	Number.	Length.	Breadth.	Height.	Solid Contents.
Sluice wall	1	24·0	2·50	3·5	210·00
Wing walls	2	3·0	1·75	2·0	21·00
Wing walls	2	3·0	1·25	1·0	7·50
Apron	1	24·0	4·00	1·0	96·00
Total solid feet foundation..					334·50

	Number.	Length.	Breadth.	Height.	Solid Contents.
Superstructure.					
Sluice walls	1	18·0	2·00	3·0	108·00
Sluice walls	2	3·0	1·75	6·5	68·25
Wing walls	2	3·0	1·25	6·5	48·75
Wing walls	2	6·0	1·00	6·5	78·00
Total solid feet superstructure...					303·00

	Number.	Length.	Breadth	Height.	Superficial Contents.
Cutstone Work.					
Facings of sides and sills of sluices	3	8·0	2·0	..	48·00
Total superficial feet 3rd sort cutstone work...					48·00

	Number.	Length.	Breadth.	Height.	Solid Contents.
Woodwork.					
Gate to sluices	3	3·5	2·5	2½	5·46
Total solid feet teak woodwork..					5·46

ABSTRACT.

702	Solid feet excavation, at 1 Rupee per 100 solid feet	7	0	3
334	Solid feet uncoursed rubble masonry, at 16 Rupees per 100 solid feet...	53	7	0
303	Solid feet coursed rubble masonry, at 20 Rupees per 100 solid feet	60	9	7
48	Superficial feet, 3rd sort cut stone work, at 45 Rupees per 100 superficial feet	21	9	7
5	Solid feet teak wood, at 4 Rupees per cubic foot	20	0	0
	Total...	162	10	5
	Add contingencies at 5 per cent.	8	2	1
	ESTABLISHMENT.			
1	Karkoon for ½ month, at 10 Rupees per month	5	0	0
1	Muccadum for ½ month, at 8 Rupees per month	4	0	0
	Total Rs...	180	0	0

F. R. GRIFFITH,
Executive Engineer for Irrigation A. N.

COMMUNICATION BRIDGE OF 32 FEET SPAN.

GENERAL DESCRIPTION.

The bridge to consist of one segmental arch of 32 feet span, 6½ feet rise, and 2 feet thick. Abutments to be 6 feet thick. Foundation of abutments to be carried down 1½ feet lower than the bed of canal, with 3″ offsets. Spandril wall to be nine feet high. Roadway to be covered with 9″ of moorum. The parapet walls to be protected from injury by traffic by guardstone.

MEASUREMENTS.

Excavating Foundation.	Number.	Length.	Breadth.	Depth.	SOLID FEET.
Abutments	2	21·5	6·5	5·5	1537·25
Wing walls	4	13·5	mean 2·75	2·5	371·25
Solid feet excavating foundation.....					1908·5

Filling in Foundation with uncoursed Rubble Stone and Lime.	Number.	Length.	Breadth.	Depth.	Solid Feet.
Abutments	2	21·5	6·5	1·5	419·25
Wing walls	4	13·5	2·75	2·5	371·25
Solid feet filling in foundation with uncoursed rubble stone and lime					790·5

Superstructure, Coursed Rubble Stone and Lime.	Number.	Length.	Breadth.	Height.	Solid Feet.	Solid Feet.
Abutments	2	21	6	4	1,008·00	
Wing walls	4	121·49	..	..	485·96	
Spandrils	2	44·00	2	9	1,584·00	
Parapet walls	2	36·5	1·5	2·5	273·75	
End pillars of walls	4	1·75	1·75	2·5	30·62	
Backing	2	17	area. 25·5		867·00	4,249·33
Deduct archway with arching	2	area. 220·69		2	882·76	882·76
Solid feet coursed rubble stone and lime masonry						3,366·57

Slabstone and Lime Arching faced with block stone.	Number.	Length.	Breadth.	Depth.	Solid Feet.
Arching	1	21	area. 77·74		1,632·54
Solid feet slabstone arching faced with block stone voussoirs					1,632·54

Coping of Cutstone, dressed, 3rd sort.	Number.	Length.	Breadth.	Depth.	Solid Feet.
Coping centre portion of parapet	2	35·5	2·5	5	88·75
Do. of end pillars	4	2·75	2·75	·5	15·12
String course cornice	2	45	·5	·5	22·5
Solid feet cutstone work, dressed, 3rd sort...					126.37

Filling in with earth.	Number.	Length.	Breadth.	Depth.	Solid Feet.
Over archway and abutments	1	17	area 124·31		2,113·27
Between wing walls	2	9	area 233·68		4,206·24
Approaches	2	171	area 139·18		47,599·56
Solid feet earthwork					53919·07

Filling in and spreading Moorum.	Number.	Length.	Breadth.	Depth.	Solid Feet.
Over bridge	1	44	18	7·5	594
Ditto approaches	2	180	20	7·5	5,400
Solid feet filling in and spreading moorum...					5,994

Guardstone.	Number.	Length.	Breadth.	Depth.	Number.
Guardstones	10	2	1	1	10
No. of Guardstones....					10

ABSTRACT.

1,908	Solid feet excavating foundation, at Rs. 0-12-0 per 100 solid feet.	14	4	11
790	Solid feet filling in ditto with uncoursed rubble stone and lime, at Rs. 16-0-0 per 100 solid feet..	126	6	4
3,367	Solid feet coursed rubble stone and lime masonry, at Rs. 20-0-0 per 100 solid feet	673	6	4
1,633	Solid feet slabstone arching faced with blockstone voussoirs, at Rs. 40-0-0 per 100 solid feet...	653	3	2
126	Solid feet coping of cutstone, dressed, 3rd sort, at Rs. 45-0-0 per 100 solid feet..	56	11	2
53,919	Solid feet filling in with earth for approaches at Rs. 0-12-0 per 100 solid feet..	404	6	3
5,994	Solid feet filling and spreading moorum, with rolling, at Rs. 1-0-0 per 100 solid feet	59	15	0
10	No. of guardstone at Rs. 1-8-0 each..	15	0	0
1	Junglewood centering at Rs. 100 per each..	100	0	0
		2,103	5	2
	Contingencies at 5 per cent	105	2	8
	Extra Establishment.			
	1 Karkoon for 6 months, at 10 Rupees per month.. 60 0 0			
	1 Muccadum do. at 8 Rupees do. .. 48 0 0	108	0	0
	Total Rs..	2,316	0	0
	Add for two more...	4,632	0	0
	Total for 3 bridges..	6,948	0	0

COMMUNICATION BRIDGE OF 25 FEET SPAN.

General Description.

The bridge to consist of one segmental arch of 25 feet span, 5 feet rise, and 1·75 feet thick. Abutments to be 5 feet thick. Foundation of abutments to be carried down 1½ foot lower than the bed of the canal with 3″ offsets. Spandril wall to be 7·25 feet high. Roadway to be covered with 9″ of moorum. The parapet walls to be protected from injury by traffic by guardstones.

Bridge of one Arch 25 feet Span.

Measurements.

Excavating Foundation.	Number.	Length.	Breadth.	Depth.	Solid Feet.
Abutments	2	21·5	5·5	5	1,182·5
Wing walls	4	10·87	mean 2·62	2	227·83
Counterforts of abutments	4	2·5	·5	5	25
Solid feet excavating foundation					1,435·33

Filling in Foundation with uncoursed rubble stone and lime.	Number.	Length.	Breadth.	Depth.	Solid Feet.
Abutments	2	21·5	5·5	1·5	354·75
Wing walls	4	10·87	mean 2·62	2	227·83
Counterforts of abutments	4	2·5	·5	1·5	7·5
Solid feet filling in foundation with uncoursed stone and lime					590·08

Superstructure—coursed rubble stone and lime masonry.	Number.	Length.	Breadth.	Height.	Solid Feet.	Solid Feet.
Abutments	2	21	·5	3·5	735	
Counterforts	4	2	·5	3·5	14	
		s. feet.				
Wing walls	4	75·51	...	..	302·04	
Spandrils	2	36	2	7·25	1,044	
Parapet walls	2	32·5	1·5	2·5	243·75	
End pillars of walls	4	1·75	1·75	2·5	30·62	
			area.			
Backing	2	17	16·25		552·5	2,821·91
		area.				
Deduct archway with arching	2	139·47		2	557·88	557·83
Solid feet coursed rubble stone and lime masonry						2,364·03

	Number.	Length.	Breadth.	th. Dep	Solid Feet.
Slabstone Arching faced with blockstone voussoirs.					
Archring	1	21	ea. 53·64		1,126·44
Solid feet slabstone arching faced with blockstone voussoirs..					1,126·44

	Number.	Length.	Breadth.	Depth.	Solid Feet.
Coping of Cutstone, dressed, 3rd sort.					
Coping centre portion of parapet	2	31·5	2·5	·5	78·75
Do. of end pillars	4	2·75	2·75	·5	15·12
String course cornice	2	37	·5	·5	18·5
Solid feet cutstone work, dressed, 3rd sort..					112·37

	Number.	Length.	Breadth.	Depth.	Solid Feet.
Filling in with earth.					
Over archway and abutment	1	17	area. 81·78		1,390·26
Between wing walls	2	7·75	area. 179·88		2,788·14
Approaches	2	137·25	area. 103.75		28,479·37
Solid feet earthwork...					32,657·77

	Number.	Length.	Breadth.	Depth.	Solid Feet.
Filling in and spreading Moorum.					
Over bridge	1	36	18	·75	486
Do. approaches	2	145	20	·75	4,350
Solid feet filling in and spreading moorum..					4,836

Guardstones.	Number.	Length.	Breadth.	Depth.	NUMBER.
Guardstones	8	2	1	1	8
				Nos. Guardstones..	8

ABSTRACT.

1,435	Solid feet excavating foundation, at Rs. 0-12-0 per 100 solid feet..	10	12	2
590	Solid feet filling in foundation, with uncoursed rubble stone and lime masonry, at Rs. 16-0-0 per 100 solid feet..	94	6	4
2,364	Solid feet coursed rubble stone and lime masonry, at Rs. 20-0-0 per 100 solid feet...	472	12	9
1,126	Solid feet slabstone arching, faced with blockstone voussoirs, at Rs. 40-0-0 per 100 solid feet..	450	6	4
112	Solid feet coping of cutstone dressed, 3rd sort, at Rs. 45-0-0 per 100 solid feet..	50	6	4
32,658	Solid feet filling in with earth for approaches, at Rs. 0-12-0 per 100 solid feet..	244	14	11
4,836	Solid feet spreading moorum with rolling, at R. 1-0-0 per 100 solid feet..	48	5	9
8	Number of Guardstones, at Rs. 1-8-0 each	12	0	0
1	Junglewood centering, at Rs. 60-0-0 each..	60	0	0
	Total...	1,444	0	7
	Add contingencies at 5 per cent...	72	3	2

EXTRA ESTABLISHMENT.

1	Carcoon for 4 months, at 10 Rupees per month..	40	0	0
1	Muccadum for 4 months, at 8 Rupees per month..	32	0	0
		72	0	0
	Total Rs.....	1,588	3	9
	Add for four more..	6,352	15	0
	Total for five bridges..	7,941	0	0

COMMUNICATION BRIDGE OF ONE ARCH 22 FEET SPAN.

General Description.

The bridge to consist of one segmental arch of 22 feet span, 4½ feet rise, and 1½ foot thick. Abutments to be 4½ feet thick. Foundation of abutments to be carried down 1½ foot lower than the bed of the canal, with 3″ offsets. Spandril wall to be 6·50 feet high. Roadway to be covered with 9″ of moorum. The parapet wall to be protected from injury by traffic by guardstones.

Measurements.

Excavating Foundation.	Number.	Length.	Breadth,	Depth.	Solid Feet.
Abutments	2	21·5	5	4·5	967·5
Wing walls	4	9·75	mean 2·62	2	204·36
Solid feet excavating foundation ..					1,171·86

Filling in Foundation with uncoursed rubble stone and lime.	Number.	Length.	Breadth.	Depth.	Solid Feet.
Abutments	2	21·5	5	1.5	322·5
Wing walls	4	9·75	mean 2·62	2	204·36
Solid feet filling in foundation ..					526·86

	Number.	Length.	Breadth.	Height.	Solid Feet.	Solid Feet.
Superstructure: coursed rubble stone and lime masonry.						
Abutments	2	21	4·5	3	567	
		s. feet.				
Wingwalls	4	73·93	..	..	295·72	
Spandrils	2	31	1·75	6·5	705·25	
Parapet walls	2	27·5	1·5	2·5	206·25	
End pillars of do.	4	1·75	1·75	2·5	30·62	
			area.			
Backing	2	17·5	13·75		481·25	2,286·09
		area.				
Deduct archway with archring...	2	108·53		1·75	379·85	379·85
Solid feet coursed rubble stone and lime masonry.....						1,906·24

	Number.	Length.	Breadth.	Depth.	Solid Feet.
Slabstone and lime Arching faced with blockstone.					
			area.		
Archring	1	21	40·46		849·66
Solid feet slabstone arching faced with blockstone voussoirs..					849·66

	Number.	Length.	Breadth.	Depth.	Solid Feet.
Coping of cutstone, dressed, 3rd sort.					
Coping, centre portion of parapet	2	26·5	2·5	·5	66·25
Do. of end pillar	4	2·75	2·75	·5	15·12
String course cornice	2	3·2	·5	·5	16
Solid feet cutstone work, dressed, 3rd sort..					97·37

	Number.	Length.	Breadth.	Depth.	Solid Feet.
Filling in with earth.					
Over archway and abutments	1	17·5	area. 65·47		1,145·72
Between wing walls	2	6·5	area. 158·13		2,055·69
Approaches	2	123·5	area. 100·05		24,712·35
			Solid feet earthwork..		27,913·76

	Number.	Length.	Breadth.	Depth.	Solid Feet.
Filling in and spreading Moorum.					
Over bridge	1	31	18	·5	279
Over approaches	2	130	20	·5	2,600
			Solid feet filling in and spreading Moorum..		2,879

	Number.	Length.	Breadth	Depth.	Number.
Guardstones.					
Guardstones	8	2	1	1	8
			Number of Guardstones...		8

ABSTRACT.

1,172	Solid feet excavating foundation, at Rs. 0-12-0 per 100	8	12	7
527	Solid feet filling in foundation with uncoursed rubble stone and lime, at Rs. 16-0-0 per 100 solid feet	84	5	1
1,906	Solid feet coursed rubble stone and lime masonry, at Rs. 20 per 100 solid feet...	381	3	2
850	Solid feet slabstone arching faced with block stone voussoirs, at Rs. 40 per 100 solid feet	340	0	0
97	Solid feet coping of cutstone, dressed, 3rd sort, at Rs. 45-0-0 per 100 solid feet	43	10	4
27,914	Solid feet filling in with earth for approaches, at Rs. 0-12-0 per 100 solid feet	209	5	8
2,879	Solid feet spreading moorum, with rolling, at Rs. 1-0-0 per 100 solid feet...	28	12	7
8	No. of Guardstones, at Rs. 1-8-0 each	12	0	0
1	Junglewood centering, at Rs. 45-0-0 each	45	0	0
	Total...	1,153	1	5
	Contingencies at 5 per cent.	57	10	5
	Extra Establishment.			
1	Carcoon for 3 months, at Rs. 10 per month 30 0 0			
1	Muccadum for 3 months, at Rs. 8 per month 24 0 0			
		54	0	0
	Total Rs....	1,265	0	0
	Add for one more	1,265	0	0
	Total for 2 Bridges...	2,530	0	0

BUNGALOW AND OUTHOUSES FOR SUPERINTENDENT OF THE LAKH IRRIGATION PROJECT.

General Description.

The Bungalow for the use of the Executive Officers in charge of the Lakh project during its construction, and after that for the accommodation of the Overseer or Superintendent of the Irrigation works, is to be built of stone and lime rubble masonry, with teak-wood roof covered with double tiles; all walls to be plastered with

single coat, and whitewashed inside and painted outside. Floors to be of well rammed moorum, with the exception of bathroom, which is to be paved with second sort cutstone. All woodwork to be of teak. Doors of two main rooms to be fitted with glass windows, also to be glazed. Everything else as per estimate.

Amount, Rupees.....2,037 0 0

Outhouses to resemble main building, with the exception of plastering and whitewashing and ceiling. They are to be covered with single tiles as per estimate.

Amount, Rupees..... 600 0 0

Total Rupees.....2,637 0 0

MEASUREMENTS.

Excavation for Foundation.	Number.	Length.	Breadth.	Height.	Solid Content.
Long walls	2	37·50	2·50	2	375·00
Short walls	3	11·00	2·50	2	165·00
Verandah long wall	1	13·50	2·25	2	60·75
Do. short wall	1	9·50	2·25	2	42·75
Do. cross walls	4	5·00	2·25	2	90·00
Verandah	1	14·50	2·00	2	58·00
Do. long side	1	37·5	2·00	2	150·00
Do. short side	1	4·0	2·00	2	16·00
Steps	2	6·0	1·50	1	18·00
Total solid feet excavation					975·50

Filling in Foundation.	Number.	Length.	Breadth.	Height.	Solid Content.
Same as excavation	.....	.....	.....	.....	975·50
Total solid feet filling in foundation					975·50

Plinth.	Number.	Length.	Breadth.	Height.	Solid Content.
Long walls	2	37·0	2·0	1·50	222·00
Short walls	3	11·5	2·0	1·50	103·50
Verandah long walls	1	13·0	1·75	1·50	34·12
Do. short wall	1	9·0	1·75	1·50	23·62
Do. cross walls	4	5·5	1·75	1·50	57·75
Verandah	1	15·0	1.50	1·50	33·75
Do. long side	1	37·0	1·50	1·50	83·25
Do. short sides	2	4·5	1·50	1·50	20·25
				Total solid feet Plinth....	578·24

Superstructure.	Number.	Length.	Breadth.	Height.	Solid Content.
Long walls	2	36·5	1·5	11·0	1,104·50
Short walls	3	12·0	1·5	11·0	594·00
Verandah long wall	1	12·5	1·25	7·0	109·37
Do, short wall	1	8·5	1·25	7·0	74·37
Do. cross wall	4	6·0	1·25	8·75	262·50
				Total...	2,144.74
Deduct.					
Doors	3	4	1·5	7·0	126·00
Doors	1	2·5	1·50	6·0	22·50
Doors	1	2·5	1·25	6·0	18·75
Doors	1	3·0	1·25	6·0	22·50
Windows	4	3·0	1·25	4·0	72·00
Windows	1	2·0	1·25	2·0	15·00
				Total solid feet superstructure....	1,867·99

	Number.	Length.	Breadth.	Height.	Square feet.
Plastering inside.					
Long walls of large room	2	20	.....	10·5	420·00
Short walls of large room	2	15	.....	10·5	315·00
Long wall of large room in verandah ...	1	10	.....	10·5	105·00
Long wall of large room in verandah ...	1	10	.....	7·25	72·50
Short walls of large room in verandah...	2	6	.....	8·75	105·00
Long wall of small room in verandah ...	1	6	.....	10·5	63·00
Long wall of small room in verandah ...	1	6	.....	7·25	43·50
Short walls of small room in verandah...	2	6	.....	8·75	105·00
Long walls of small room	2	12	.....	10·5	252·00
Short walls of small room	2	10	.....	10·5	210·00
				Total...	1691·00
Deduct.					
Doors	4	4·0	.....	7	112
Doors	2	2·5	.....	6	30
Doors	1	3·0	.....	6	18
Windows	4	3·0	.....	4	48
Windows	3	2·0	.....	2	12
				Total...	220
Total square feet plastering.....					1,471

	Number.	Length.	Breadth.	Height.	Superficial Content.
Whitewash.					
Same as plastering	...	...	...	...	1,471
Total superficial feet whitewash...					1,471

Woodwork.

	Number.	Length.	Breadth.	Height.	Solid Content.
Wall plates, long walls	2	36·5	·33	·41	9·87
Wall plates, short walls	2	18·0	·33	·41	4·87
Wall plates, long wall in verandah ...	1	12·5	·33	·33	1·36
Wall plates, short wall in verandah ...	1	8·5	·33	·33	·92
Wall plates, cross walls in verandah ...	4	8·5	·33	·33	3·79
Posts in verandah	6	·33	·33	7·5	4·90
Post plate	1	37·0	·33	·33	4·02
Post plate	1	16·5	·33	·33	1·79
Pole plates long walls	2	36·5	·33	·41	9·87
Pole plates short walls	2	18·0	·33	·41	4·87
Total solid feet woodwork ...					46·26

Roofing.

	Number.	Length.	Breadth.	Height.	Superficial Content.
Main Bungalow	1	2	39 × 15	·57	666·90
Verandah	1	39	8·75	....	341·25
Verandah	1	39	10.25	....	399·75
Total superficial feet roofing...					1407·90

Flooring.

	Number.	Length.	Breadth.	Height	Solid Content.
Large room	1	19·5	14·5	1·5	424·12
Small room	1	11·5	14·5	1·5	250·12
Verandah large room	1	9·5	5·5	1·5	78·37
Verandah small room	1	5·5	5·5	1·5	45·37
Verandah	1	15·0	4·75	1·5	106·85
Verandah	1	33·5	4·75	1·5	226·12
Total solid feet of flooring.....					1,130·95

Ceiling.

	Number.	Length.	Breadth.	Height.	Superficial. Content.
Large room	1	20	15	....	300
Small room	1	12	15	....	180
Room in Verandah	1	6	6	....	36
Total superficial feet ceiling.....					516

Cutstone Work.

	Number.	Length.	Breadth.	Height.	Solid Content.
Steps, 1st Course	2	6	1·5	1	18
Steps, 2nd Course	2	6	1·0	.75	9
Total solid feet for cutstone work.....					27

Pavement.

	Number.	Length.	Breadth.	Height.	Superficial. Content.
Paving the small room in verandah.....	1	6	6	....	36
Total superficial feet pavement.....					36

Doors and Windows.	Number.	Length.	Breadth.
Doors	3	4	7
Doors	2	2·5	6
Doors	1	3	6
Windows	4	3	4
Windows	3	2	2

ABSTRACT.

975·50	Solid feet excavation, at 12 annas per 100 solid feet	7	5	0
975·50	Solid feet filling in foundation, at 16 rupees per 100 solid feet	156	1	3
578·24	Solid feet plinth, at 16 rupees per 100 solid feet	92	8	4
1,867·99	Solid feet of superstructure uncoursed rubble masonry and chunam, at 18 rupees per 100 solid feet	336	3	10
1,471·00	Superficial feet plastering, at 6 rupees per 100 superficial feet	88	4	2
1,471·00	Superficial feet whitewash, at 5 annas per 100 superficial feet	4	9	7
46·26	Solid feet woodwork, at 4 rupees per cubic foot	185	0	8
1,407·90	Superficial feet roofing, at 45 rupees per 100 superficial feet	633	8	11
1,130·95	Solid feet flooring, at 1½ rupee per 100 solid feet	16	15	5
516·00	Superficial feet ceiling, at 15 rupees per 100 superficial feet	77	6	5
27·00	Solid feet cutstone work, at 30 rupees per 100 solid feet	8	1	7
36·00	Superficial feet pavement, at 35 rupees per 100 superficial feet	12	9	7
3	Doors at 42 rupees	126	0	0
2	Doors at 18¾ rupees	37	8	0
1	Door at 22½ rupees	22	8	0
4	Windows at 18 rupees	72	0	0
3	Windows at 4 rupees	12	0	0
	Total	1,888	10	9
	Add contingencies at 5 per cent.	94	6	6

ESTABLISHMENT.

1	Karkoon for 3 months, at 10 rupees per month	30	0	0
1	Muccadum for 3 months, at 8 rupees per month	24	0	0
	Total	2,037	0	0

OUTHOUSES.

Measurements.

Excavation for Foundation.	Number.	Length.	Breadth.	Height.	Solid Feet.
Long walls	2	21	2·25	2	189·00
Short wall	1	15	2·25	2	67·50
Do.	1	15	2·50	2	75·00
Intermediate wall	1	7	2·25	2	31·50
Verandah	1	15	2·00	2	60·00
Total solid feet excavation....					423·00

Filling in Foundation.	Number.	Length.	Breadth.	Height.	Solid Feet.
Same as Excavation	..	..	..	..	423·00
Total solid feet filling in foundation....					423·00

Plinth.	Number.	Length.	Breadth.	Height.	Solid Feet.
Long walls	2	20·50	1·75	1	71·75
Short wall	1	15·50	1·75	1	27·12
Short wall	1	15·50	2·00	1	31·00
Intermediate wall	1	7·50	1·75	1	13·12
Verandah	1	15·50	1·50	1	23·25
Total solid feet plinth....					166·24

Superstructure.	Number.	Length.	Breadth.	Height.	Solid Feet.
Long walls	2	20	1·25	8·0	400·00
Triangular portion over long walls ..	2	10	1·25	5·6	140·00
Short wall	1	16	1·25	8·0	160·00
Short wall	1	16	1·50	13·6	326·40
Intermediate wall	1	8	1·25	8·0	80·00
Triangular portion over intermediate wall.	1	4	1·25	5·6	28·00
Seats	1	5	1·5	1.5	11·25
Ovens	1	8	3·0	2.5	60·00
				Total...	1,205·65
Deduct.					
Door	1	3.0	1·25	6	22·50
Door	1	2.5	1·25	6	18·75
Windows	2	2.0	1·25	2	10·00
				Total...	51·25
Total solid feet superstructure....					1,154·40

Woodwork.	Number.	Length.	Breadth	Height.	Solid feet.
Plank over the seats	1	6·0	1·5	·12	·96
Wall plates long walls	2	22·0	·25	·33	3·66
Do. short walls	2	18·5	·25	·33	3·05
Do. intermediate wall	1	10·5	·25	·33	·86
Posts in the verandah	1	·33	·33	8·00	·87
Postplates	1	18·5	·33	·41	2·40
Total solid feet woodwork....					11·80

Roofing.	Number.	Length.	Breadth.	Height.	Superficial Feet.
Roof over the building	1	2×	21×20	×.57	478·80
Roof over the chimney	1	5	8	..	40·00
Total superficial feet roofing....					518·80

Doors and Windows.	Number.	Length.	Breadth.	Height.	TOTAL.
Door	1	3	..	6	..
Door	1	2.5	..	6	..
Windows	2	2	..	2	..

ABSTRACT.

423	Solid feet excavation, at 12 annas per 100 solid feet	3	2	9
423	Solid feet filling in foundation, at 16 Rs. per 100 solid feet ..	67	10	11
166·24	Solid feet plinth, at 16 Rs. per 100 solid feet..	26	9	7
1,154·40	Solid feet superstructure uncoursed rubble masonry, at 18 Rs. per 100 solid feet	207	12	8
508·80	Roofing, at 30 Rs. per 100 superficial feet	152	10	3
11·80	Solid feet woodwork, at 4 Rs. per cubic feet..	47	3	2
1	Doors at 22½ Rupees each	22	8	0
1	Door at 18¾ Rupees each	18	12	0
2	Windows at 4 Rupees each	8	0	0
	Total....	554	5	4
	Add Contingencies at 5 per cent	27	11	6
	ESTABLISHMENT.			
1	Kerkoon for one month, at 10 Rs. per month	10	0	0
1	Muccadum for one month, at 8 Rs. per month	8	0	0
	Total amount....	600	0	0

Bungalow..... 2,037
Outhouses 600

Total.... 2,637

(Signed) J. G. T. GRIFFITH,
Executive Engineer for Irrigation A. & N.

RECAPITULATION.

1	Dam and head works	58,783	0 0
2	Canals	1,00,167	0 0
2	Aqueducts of one arch, 10 ft. span, and 17¼ ft. breadth at bottom, in the 3rd mile	2,942	0 0
1	Aqueduct of 6 arches, 10 ft. span, 16¼ ft. breadth at bottom, in the 5th mile	3,707	0 0
3	Aqueducts of one arch, 10 ft. span, 16¼ ft. breadth at bottom, between the 4th and 6th miles	4,455	0 0
4	Aqueducts of one arch, 10 ft. span, 15 ft. breadth at bottom, between the 6th and 9th miles	5,896	0 0
1	Aqueduct of 2 arches, 10 ft. span, 15 ft. breadth at bottom, in the 8th mile	1,703	0 0
2	Aqueducts of one arch, 10 ft. span, 13¾ ft. breadth at bottom, between the 9th and 13th miles	1,456	0 0
1	Aqueduct of 4 arches, 10 ft. feet span, 13¾ ft. breadth at bottom, in the 12th mile	2,551	0 0
2	Aqueducts of one arch, 10 ft. span, 12½ ft. breadth at bottom, between the 14th and 15th miles	2,688	0 0

ESCAPES.

1	Escape of 2 feet openings, 2 by 4	194	0 0
3	Do. do. 2 by 3	306	0 0
1	Do. 3 do. 2 by 3	180	0 0

COMMUNICATION BRIDGES.

3	Bridges of 32 feet span	6,948	0 0
5	Do. 25 do.	7,941	0 0
2	Do. 22 do.	2,530	0 0
A	Bungalow with outhouses	2,637	0 0
		2,05,048	0 0
25	Regulators for branch canals, at 250 Rs. each	6,250	0 0
	Total Rs.	2,11,829	0 0

(Signed) J. G. T. GRIFFITH,
Executive Engineer for Irrigation A. & N.

(Signed) J. G. FIFE, Lieutenant-Colonel,
Superintending Engineer for Irrigation.

540 C. W.
No. 1212 OF 1866.

Public Works Department.

Bombay Castle,
18th June 1866.

Letter from the Acting Revenue Commissioner Southern Division, No. 2077, dated 19th June 1865.

Submits a letter from the Superintending Engineer for Irrigation, with plans and estimates for a project for irrigating land in the Paihra and Godavery Valleys, near Newassa, in the Ahmednuggur Collectorate.

RESOLUTION.—The project should be submitted to the Government of India for inclusion in the list of those for which it is recommended a loan should be raised.

2. It appears that the estimate of revenue is derived from areas of land capable of being watered by one cubic foot of supply per second.

	Mr. Griffith gives:— *Rate.*	Major Francis:— *Rate.*
Sugarcane, 100 acres	4 Rs.	6 Rs.
Rubbee 150 „	3 „	4 „
Monsoon 100 „	2 „	2 „

3. Captain Baird Smith, R. E., (Bengal) in his Italian Irrigation gives, at the following rates:—

Summer Meadow	90 acres.	Per cubic foot per second.
Winter „	3 „	
Rice	40 „	
Indian Corns, &c.	180 „	

and classes sugarcane with rice.

4. Mr. Griffith's estimate of Rubbee irrigation might be classed with Captain Baird Smith's Indian Corns, &c., but inasmuch as the evaporation may be considered greater in India than Italy, the quantity of land will be less, and may be left at 150 acres.

5. The monsoon crops (Khurreef), composed of rice and indigo, being chiefly reared by the water of the direct rainfall, may

not require more assistance from irrigation than Mr. Griffith has estimated.

This would give:—

* Major Francis' rates.	600	acres	@	*6 Rs.	3,600
	5,400	„	@	4 „	21,600
	10,100	„	@	2 „	20,200
					45,400
				Deduct maintainance....	10,564
					34,836

which would give 16½ per cent. interest, and this is probably the minimum.

Major Francis' estimate is	20	per cent.
Colonel Fife's on Mr. Griffith's low rates	15	„
Mr. Griffith's own	16	„

T. F. DOWDEN, Lieut., R. E.,
Under Secretary to Government.

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